Hydraulic Bolt Tensioning Equipment, Health & Safety, Operating and Maintenance Instruction Manual

Customer Name	TITAN Technologies Korea
Customer Order No	
Titan Job No	Q620
Date	November 2006

Copyright Statement

CONTENTS

SECTION 1

TECHNICAL INFORMATION

Technical Information

Summary of Equipment Supplied

2 off	Tool No 27 for 4 inch UN8 bolting	T-4000-T27
6 off	Tool No 27 for 3-3/4 inch UN8 bolting	T-3750-T27
4 off	Tool No 26 for 3-1/2 inch UN8 bolting	T-3500-T26
6 off	Tool No 25 for 3 inch UN8 bolting	T-3000-T25
4 off	Tool No 25 for 2-3/4 inch UN8 bolting	T-2750-T25
10 off	Tool No 24 for 2-1/2 inch UN8 bolting	T-2500-T24
4 off	Tool No 24 for 2-1/4” UN8 bolting	T-2250-T24
4 off	Tool No 23 for 1-7/8 inch UN8 bolting	T-1875-T23
4 off	Tool No 23 for 1-5/8 inch UN8 bolting	T-1625-T23
4 off	Tool No 22 for 1-1/2 inch UN8 bolting	T-1500-T22
4 off	Tool No 21 for 1-1/8” UN8 bolting	T-1125-T21
8 off	Tool No 21 for 1 inch UNC bolting	T-1000-T21
4 off	Tool No 21 fore 7/8” UNC bolting	T-0875-T21
5 off	Link Hose 1.5 m long	T-1540-1.5
5 off	Seal Kit for Tool No 27	T-SK-T27
5 off	Seal Kit for Tool No 26	T-SK-T26
5 off	Seal Kit for Tool No 25	T-SK-T25
5 off	Seal Kit for Tool No 24	T-SK-T24
5 off	Seal Kit for Tool No 23	T-SK-T23
5 off	Seal Kit for Tool No 22	T-SK-T22
5 off	Seal Kit for Tool No 21	T-SK-T21
4 off	Tommy Bar 20 mm dia	T-TB-20
4 off	Tommy Bar 16 mm dia	T-TB-16
4 off	Tommy Bar 14 mm dia	T-TB-14
4 off	Tommy Bar 12 mm dia	T-TB-12
4 off	Tommy Bar 10 mm dia	T-TB-10
4 off	Tommy Bar 8 mm dia	T-TB-8
4 off	Tommy Bar 6 mm dia	T-TB-6
1 off	Pressure Test Certificate	
1 off	Operating Manual	

All above equipment designated for 1500 bar maximum working pressure

Technical Information

Tool No 21

Pressure Area	1,555 mm^2
Maximum Working Pressure	1500 bar
Maximum Load	233 kN

Tool No 22

Pressure Area	2,884 mm^2
Maximum Working Pressure	1500 bar
Maximum Load	433 kN

Tool No 23

Pressure Area	5,271 mm^2
Maximum Working Pressure	1500 bar
Maximum Load	791 kN

Tool No 24

Pressure Area	8,445 mm^2
Maximum Working Pressure	1500 bar
Maximum Load	1,267 kN

Tool No 25

Pressure Area	12,197 mm^2
Maximum Working Pressure	1500 bar
Maximum Load	1,830 kN

Tool No 26

Pressure Area	16,682 mm^2
Maximum Working Pressure	1500 bar
Maximum Load	2,502 kN

Tool No 27

Pressure Area	17,530 mm^2
Maximum Working Pressure	1500 bar
Maximum Load	2,629 kN

Technical Information

Fatigue Life

The Puller of the Bolt Tensioning Tool is subject to fatigue loading during normal operation of the equipment. The Pullers provided have a fatigue life of between 10,000 and 20,000 cycles at full operating pressure. Provision should be made to replace the Pullers at 10,000 pressure cycles.

Test Certificate

RAPID-TORC.SA
BIG NUTS - BIG TOOLS™
WWW.RAPIDTORC.COM

PRESSURE TEST CERTIFICATE

Date Issued 22nd November 2006
Certificate No 285
Job No Q620

Equipment covered by this certificate

2 off	Tool No 27 for 4" UN8	Serial No's RN793 and RN797
6 off	Tool No 27 for 3-3/4" UN8	Serial No's RN791, RN792, RN794 to RN796, RN799
4 off	Tool No 26 for 3-1/2 UN8	Serial No's RN529, RN773, RN804, RN806
6 off	Tool No 25 for 3" UN8	Serial No's RN604 to RN607, RN609, RN610
4 off	Tool No 25 for 2-3/4" UN8	Serial No's RN936 to RN939
10 off	Tool No 24 for 2-1/2" UN8	Serial No's RN875 to RN878, RN881 to RN886
4 off	Tool No 24 for 2-1/4" UN8	Serial No's RN549, RN551, RN749, RN752
4 off	Tool No 23 for 1-7/8" UN8	Serial No's RN835 to RN838
4 off	Tool No 23 for 1-5/8" UN8	Serial No's RN655, RN657, RN658, RN659
4 off	Tool No 22 for 1-1/2" UN8	Serial No's RN787, RN789, RN853, RN860
4 off	Tool No 21 for 1-1/8" UN8	Serial No's RN815 to RN818
8 off	Tool No 21 for 1" UNC	Serial No's RN814, RN823 to RN828
4 off	Tool No 21 for 7/8" UNC	Serial No's RN819 to RN822
5 off	1.5m Flexible Hoses	Serial No's RS450, RS452, RS453, RS455, RS456

The above equipment was successfully pressure tested at 1800 bar.

Tested using hydraulic oil (ISO 10)

We certify the above equipment was subject to inspection and test according to the company standard procedures.

The maximum working pressure for this equipment is 1500 bar

Authorised Signature

.....
Test Engineer

PARTS LIST FOR TOOL TRM 21 for 7/8 inch UNC

Part No	Description	Quantity
T-3650-00	No 21 Cylinder Body	1
T-3651-00	No 21 Piston	1
T-1739-00	No 21 Puller for 7/8 inch UNC	1
T-0417-00	No 21 Socket for 7/8 inch	1
T-3545-00	No 21 Bridge for ¾" and 7/8 inch	1
T-BRSDP-M506	Bridge Retaining Screw	2
T-SK-T21	Seal Kit for Tool No 21	1
T-IR-T21	Red Plastic Stroke Indicator for Tool No 21	1
T-1502	Quick connect nipple	1
T-1524	Male/male adaptor	1
T-1533	Bonded Washer Seal	1
T-1510	Plastic dust cap for nipple	1
T-L1-T21	Label for Tool No 21	1

Hydraulic Cylinder No 21

7/8" UNC Puller
T-1739-00

3/4 inch and 7/8 inch Bridge
T-3545-00

7/8" Socket
T-0417-00

PARTS LIST FOR TOOL TRM 21 for 1 inch UNC

Part No	Description	Quantity
T-3650-00	No 21 Cylinder Body	1
T-3651-00	No 21 Piston	1
T-1738-00	No 21 Puller for 1 inch UNC	1
T-0398-00	No 21 Socket for 1 inch	1
T-3546-00	No 21 Bridge for 1 inch and 1-1/8 inch	1
T-BRSDP-M506	Bridge Retaining Screw	2
T-SK-T21	Seal Kit for Tool No 21	1
T-IR-T21	Red Plastic Stroke Indicator for Tool No 21	1
T-1502	Quick connect nipple	1
T-1524	Male/male adaptor	1
T-1533	Bonded Washer Seal	1
T-1510	Plastic dust cap for nipple	1
T-L1-T21	Label for Tool No 21	1

Hydraulic Cylinder No 21

1” UNC Puller
T-1738-00

1 inch and 1-1/8 inch Bridge
T-3546-00

1” Socket
T-0398-00

PARTS LIST FOR TOOL TRM 21 for 1-1/8 inch UN8

Part No	Description	Quantity
T-3650-00	No 21 Cylinder Body	1
T-3651-00	No 21 Piston	1
T-1737-01	No 21 Puller for 1-1/8 inch UN8	1
T-0399-02	No 21 Socket for 1-1/8 inch	1
T-3546-00	No 21 Bridge for 1 inch and 1-1/8 inch	1
T-BRSDP-M506	Bridge Retaining Screw	2
T-SK-T21	Seal Kit for Tool No 21	1
T-IR-T21	Red Plastic Stroke Indicator for Tool No 21	1
T-1502	Quick connect nipple	1
T-1524	Male/male adaptor	1
T-1533	Bonded Washer Seal	1
T-1510	Plastic dust cap for nipple	1
T-L1-T21	Label for Tool No 21	1

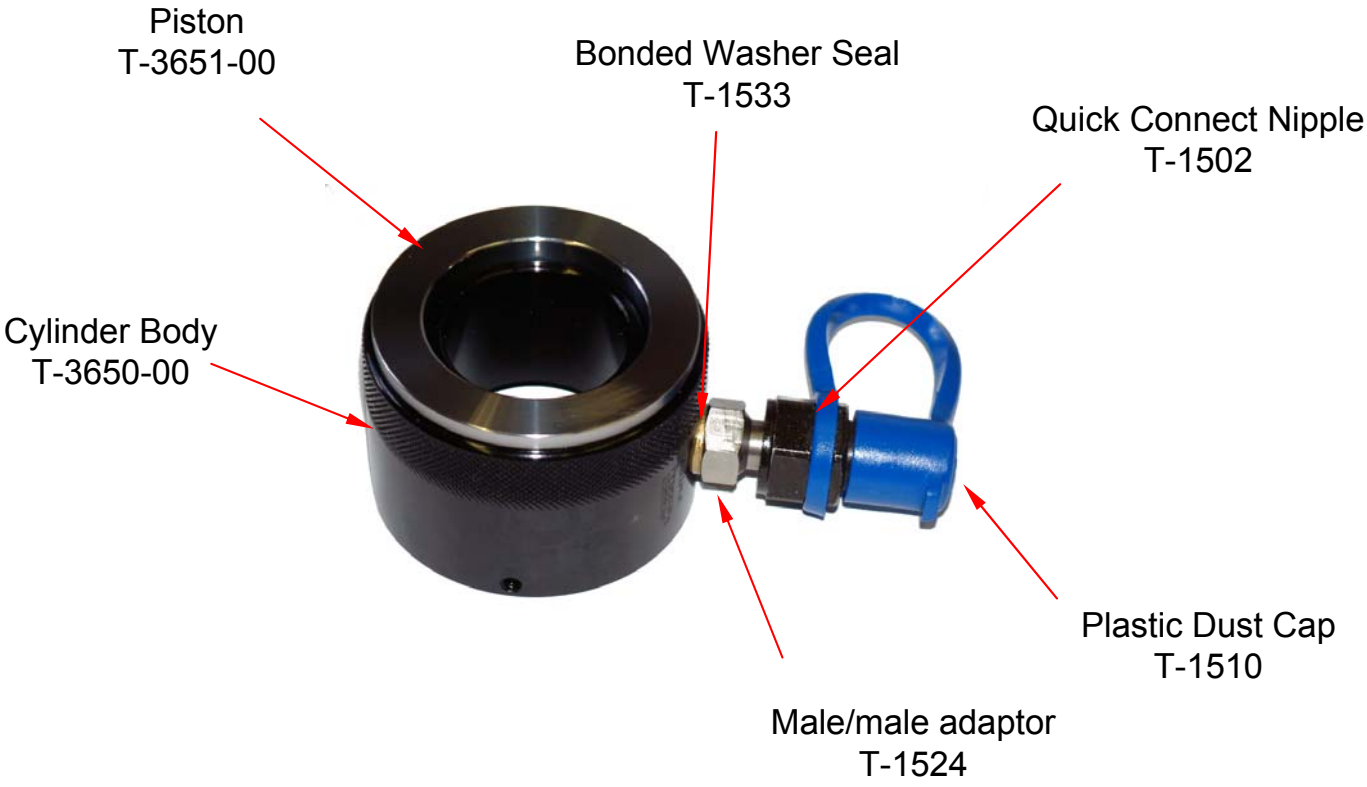
Hydraulic Cylinder No 21

1-1/8” UN8 Puller
T-1737-01

1 inch and 1-1/8 inch Bridge
T-3546-00

1-1/8” Socket
T-0399-02

PARTS LIST FOR TOOL TRM 21



Cylinder Assembly No 21

Stroke Indicator
T-IR-T21

Seal Kit
T-SK-T21

PARTS LIST FOR TOOL TRM 22 for 1-1/2 inch UN8

Part No	Description	Quantity
T-1985-00	No 22 Cylinder Body	1
T-1998-00	No 22 Piston	1
T-0589-02	No 22 Puller for 1-1/2 inch UN8	1
T-0816-01	No 22 Socket for 1-1/2 inch	1
T-0592-03	No 22 Bridge for 1-3/8 inch and 1-1/2 inch	1
T-BRSDP-M510	Bridge Retaining Screw	2
T-SK-T22	Seal Kit for Tool No 22	1
T-IR-T22	Red Plastic Stroke Indicator for Tool No 22	1
T-1502	Quick connect nipple	1
T-1503	Male/male adaptor	1
T-1510	Plastic dust cap for nipple	1
T-L1-T22	Label for Tool No 22	1

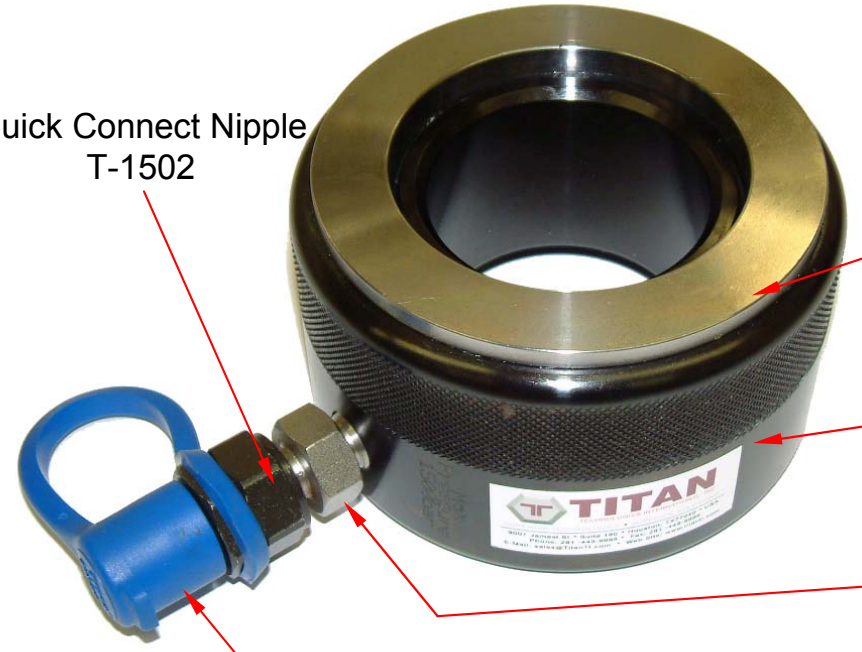
Hydraulic Cylinder No 22

1-1/2” UN8 Puller
T-0589-02

1-3/8 inch and 1-1/2 inch Bridge
T-0592-03

1-1/2” Socket
T-0816-01

PARTS LIST FOR TOOL TRM 22



Cylinder Assembly No 22

Stroke Indicator
T-IR-T22

Seal Kit
T-SK-T22

PARTS LIST FOR TOOL TRM 23 for 1-5/8 inch UN8

Part No	Description	Quantity
T-1989-01	No 23 Cylinder Body	1
T-0622-01	No 23 Piston	1
T-0809-01	No 23 Puller for 1-5/8 inch UN8	1
T-0813-01	No 23 Socket for 1-5/8 inch	1
T-0804-02	No 23 Bridge for 1-5/8 inch and 1-3/4	1
T-BRSDP-M512	Bridge Retaining Screw	2
T-SK-T23	Seal Kit for Tool No 23	1
T-IR-T23	Red Plastic Stroke Indicator for Tool No 23	1
T-1502	Quick connect nipple	1
T-1503	Male/male adaptor	1
T-1510	Plastic dust cap for nipple	1
T-L1-T23	Label for Tool No 23	1

Hydraulic Cylinder No 23

1-5/8” UN8 Puller
T-0809-01

1-5/8 inch and 1-3/4 inch Bridge
T-0804-02

1-5/8” Socket
T-0813-01

PARTS LIST FOR TOOL TRM 23 for 1-7/8 inch UN8

Part No	Description	Quantity
T-1989-01	No 23 Cylinder Body	1
T-0622-01	No 23 Piston	1
T-0807-01	No 23 Puller for 1-7/8 inch UN8	1
T-0811-01	No 23 Socket for 1-7/8 inch	1
T-0805-03	No 23 Bridge for 1-7/8 inch and 2 inch	1
T-BRSDP-M512	Bridge Retaining Screw	2
T-SK-T23	Seal Kit for Tool No 23	1
T-IR-T23	Red Plastic Stroke Indicator for Tool No 23	1
T-1502	Quick connect nipple	1
T-1503	Male/male adaptor	1
T-1510	Plastic dust cap for nipple	1
T-L1-T23	Label for Tool No 23	1

Hydraulic Cylinder No 23

1-7/8” UN8 Puller
T-0807-01

1-7/8 inch and 2 inch Bridge
T-0805-03

1-7/8” Socket
T-0811-01

PARTS LIST FOR TOOL TRM 23

Quick Connect Nipple
T-1502

Piston
T-0622-01

Cylinder Body
T-1989-01

Male/male adaptor
T-1503

Plastic Dust Cap
T-1510

Cylinder Assembly No 23

Stroke Indicator
T-IR-T23

Seal Kit
T-SK-T23

PARTS LIST FOR TOOL TRM 24 for 2-1/4 inch UN8

Part No	Description	Quantity
T-3021-00	No 24 Cylinder Body	1
T-3022-01	No 24 Piston	1
T-0682-00	No 24 Puller for 2-1/4 inch UN8	1
T-3464-00	No 29 Socket for 2-1/4 inch	1
T-3682-00	No 24 Bridge for 2-1/4 inch	1
T-BRSDP-M512	Bridge Retaining Screw	3
T-SK-T24	Seal Kit for Tool No 24	1
T-IR-T24	Red Plastic Stroke Indicator for Tool No 24	1
T-1502	Quick connect nipple	1
T-1503	Male/male adaptor	1
T-1510	Plastic dust cap for nipple	1
T-L1-T24	Label for Tool No 24	1

Hydraulic Cylinder No 24

2-1/4” UN8 Puller
T-0682-00

2-1/4” Bridge
T-3682-00

2-1/4” Socket
T-3464-00

PARTS LIST FOR TOOL TRM 24 for 2-1/2 inch UN8

Part No	Description	Quantity
T-3021-00	No 24 Cylinder Body	1
T-3022-01	No 24 Piston	1
T-0681-00	No 24 Puller for 2-1/2 inch UN8	1
T-3024-00	No 24 Socket for 2-1/2 inch	1
T-3223-01	No 24 Bridge for 2-1/2 inch	1
T-BRSDP-M512	Bridge Retaining Screw	3
T-SK-T24	Seal Kit for Tool No 24	1
T-IR-T24	Red Plastic Stroke Indicator for Tool No 24	1
T-1502	Quick connect nipple	1
T-1503	Male/male adaptor	1
T-1510	Plastic dust cap for nipple	1
T-L1-T24	Label for Tool No 24	1

Hydraulic Cylinder No 24

2-1/2” UN8 Puller
T-0681-00

2-1/2” Bridge
T-3223-01

2-1/2” Socket
T-3024-00

PARTS LIST FOR TOOL TRM 24

Cylinder Assembly No 24

Stroke Indicator
T-IR-T24

Seal Kit
T-SK-T24

PARTS LIST FOR TOOL TRM 25 for 2-3/4 inch UN8

Part No	Description	Quantity
T-1654A-01	No 25 Cylinder Body	1
T-1654B-01	No 25 Piston	1
T-0831-01	No 25 Puller for 2-3/4 inch UN8	1
T-1976-00	No 25 Socket for 2-3/4 inch	1
T-1975-01	No 25 Bridge for 2-3/4 inch	1
T-BRSDP-M512	Bridge Retaining Screw	3
T-SK-T25	Seal Kit for Tool No 25	1
T-IR-T25	Red Plastic Stroke Indicator for Tool No 25	1
T-1502	Quick connect nipple	1
T-1503	Male/male adaptor	1
T-1510	Plastic dust cap for nipple	1
T-L1-T25	Label for Tool No 25	1

Hydraulic Cylinder No 25

2-3/4” UN8 Puller
T-0831-01

2-3/4” Bridge
T-1975-01

2-3/4” Socket
T-1976-00

PARTS LIST FOR TOOL TRM 25 for 3 inch UN8

Part No	Description	Quantity
T-1654A-01	No 25 Cylinder Body	1
T-1654B-01	No 25 Piston	1
T-0830-01	No 25 Puller for 3 inch UN8	1
T-0353-02	No 25 Socket for 3 inch	1
T-1977-00	No 25 Bridge for 3 inch	1
T-BRSDP-M512	Bridge Retaining Screw	3
T-SK-T25	Seal Kit for Tool No 25	1
T-IR-T25	Red Plastic Stroke Indicator for Tool No 25	1
T-1502	Quick connect nipple	1
T-1503	Male/male adaptor	1
T-1510	Plastic dust cap for nipple	1
T-L1-T25	Label for Tool No 25	1

Hydraulic Cylinder No 25

3” UN8 Puller
T-0830-01

3” Bridge
T-1977-00

3” Socket
T-0353-02

PARTS LIST FOR TOOL TRM 25

Quick Connect Nipple
T-1502

Piston
T-1654A-01

Cylinder Body
T-1654B-01

Male/male adaptor
T-1503

Plastic Dust Cap
T-1510

Cylinder Assembly No 25

Stroke Indicator
T-IR-T25

Seal Kit
T-SK-T25

PARTS LIST FOR TOOL TRM 26 for 3-1/2 inch UN8

Part No	Description	Quantity
T-0737-00	Cylinder Body	1
T-0729-00	Piston	1
T-0727-01	Puller No 26 for 3-1/2 inch UN8	1
T-0732-00	Socket for 3-1/2 inch	1
T-0736-00	Bridge for 3-1/2 inch	1
T-BRSDP-M612	Bridge retaining screw	3
T-SK-T26	Seal Kit for Tool No 26	1
T-IR-T26	Red Plastic Stroke Indicator for Tool No 26	1
T-1502	Quick connect nipple	1
T-1503	Male/male adaptor	1
T-1510	Plastic dust cap for nipple	1
T-L1-T26	Label for Tool No 26	1

Hydraulic Cylinder No 26

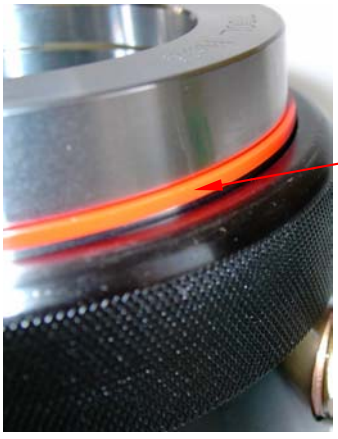
3-1/2” UN8 Puller
T-0727-01

3-1/2 inch Bridge
T-0736-00

3-1/2 inch Socket
T-0732-00

PARTS LIST FOR TOOL TRM 26

Cylinder Assembly



Stroke Indicator
T-IR-T26

Seal Kit
T-SK-T26

PARTS LIST FOR TOOL TRM 27 for 3-3/4 inch UN8

Part No	Description	Quantity
T-3093-00	Cylinder Body	1
T-3094-00	Piston	1
T-3091-00	Puller No 27 for 3-3/4 inch UN8	1
T-3098-00	Socket for 3-3/4 inch	1
T-3099-00	Bridge for 3-3/4 inch	1
T-BRSDP-M612	Bridge retaining screw	3
T-SK-T27	Seal Kit for Tool No 27	1
T-IR-T27	Red Plastic Stroke Indicator for Tool No 27	1
T-1502	Quick connect nipple	1
T-1503	Male/male adaptor	1
T-1510	Plastic dust cap for nipple	1
T-L1-T27	Label for Tool No 27	1

Hydraulic Cylinder No 27

3-3/4” UN8 Puller
T-3091-00

3-3/4 inch Bridge
T-3099-00

3-3/4 inch Socket
T-3098-00

PARTS LIST FOR TOOL TRM 27 for 4 inch UN8

Part No	Description	Quantity
T-3093-00	Cylinder Body	1
T-3094-00	Piston	1
T-3092-00	Puller No 27 for 4 inch UN8	1
T-3096-00	Socket for 4 inch	1
T-3609-00	Bridge for 4 inch	1
T-BRSDP-M612	Bridge retaining screw	3
T-SK-T27	Seal Kit for Tool No 27	1
T-IR-T27	Red Plastic Stroke Indicator for Tool No 27	1
T-1502	Quick connect nipple	1
T-1503	Male/male adaptor	1
T-1510	Plastic dust cap for nipple	1
T-L1-T27	Label for Tool No 27	1

Hydraulic Cylinder No 27

4” UN8 Puller
T-3092-00

4 inch Bridge
T-3609-00

4 inch Socket
T-3096-00

PARTS LIST FOR TOOL TRM 27

Quick Connect Nipple
T-1502

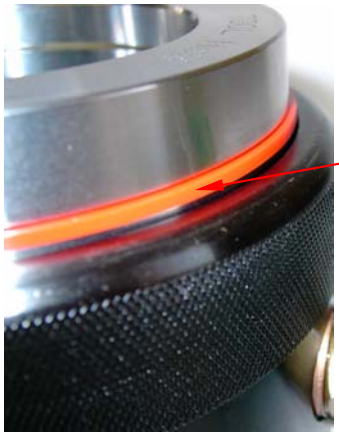
Piston
T-3094-00

Cylinder Body
T-3093-00

Male/male adaptor
T-1503

Plastic Dust Cap
T-1510

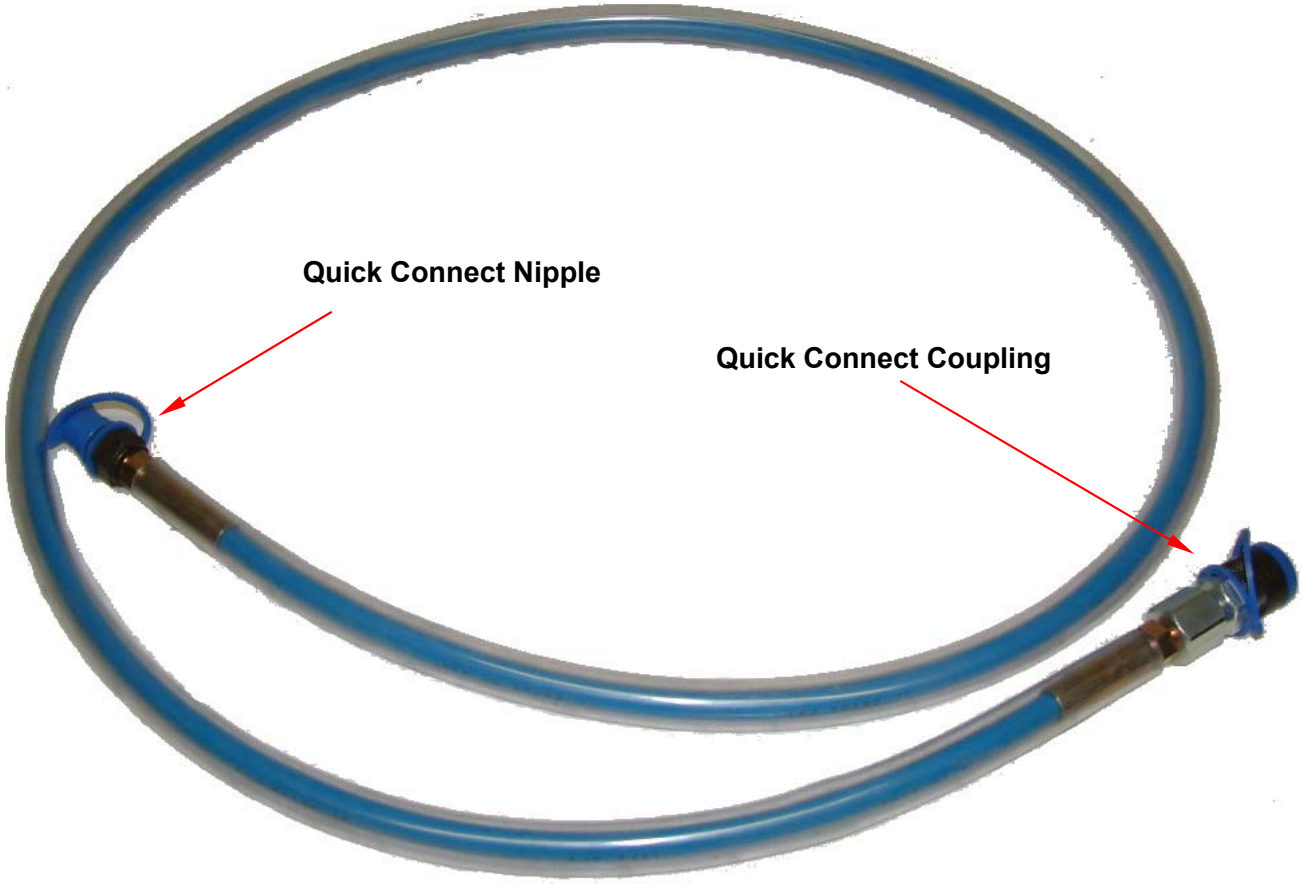
Cylinder Assembly No 27



Stroke Indicator
T-IR-T27

Seal Kit
T-SK-T27

PICTURE of 1.5 m long 1500 bar hose



High Pressure Flexible Hose complete with self sealing quick connectors at each end

1.5 m Long Part No T-1540-1.5

PICTURES of tool fittings for Tool TRM 22 to 29

Male/Male adaptor

T-1503

Quick Connect Nipple
T-1502

PICTURES of tool fittings for Tool TRM 21

T-1510
Dust Cap

T-1502
Quick Connect
Nipple

T-1524
Male / Male
Adaptor

T-1533
Bonded
Washer
Seal

OIL PRESSURE CALCULATION AND GRAPHS

The formula used to calculate the Oil Pressure to be used with a bolt tensioning tool are given below along with definitions of the terms used :-

Bolt Load
Residual Bolt Load required when the tensioning operation is complete

Tensioning Force
The load that will be applied by the bolt tensioner during the tensioning operation

Load Loss Allowance
The ratio of ***Tensioning Force*** to ***Bolt Load***

$$\textit{Load Loss Allowance} = \frac{\textit{Tensioning Force}}{\textit{Bolt Load}} = 1.01 + \frac{\text{Bolt Diameter}}{\text{Grip Length}}$$

If the ***Load Loss Allowance*** calculates to less than 1.10 then use 1.10.

Tensioning Force = Bolt Load x Load Loss Allowance

Always check that the tensioning force will not exceed 90% of the yield strength of the bolt material. If it does, the grip length of the bolt must be increased. Contact TITAN for advice on this.

$$\textit{Oil Pressure}\ (\text{bar}) = \frac{\textbf{10 x}\ \textit{Tensioning Force}\ (\text{Newtons})}{\textit{Tool Pressure Area}\ (\text{mm}^2)}$$

Oil pressure graphs are provided for each bolt size.

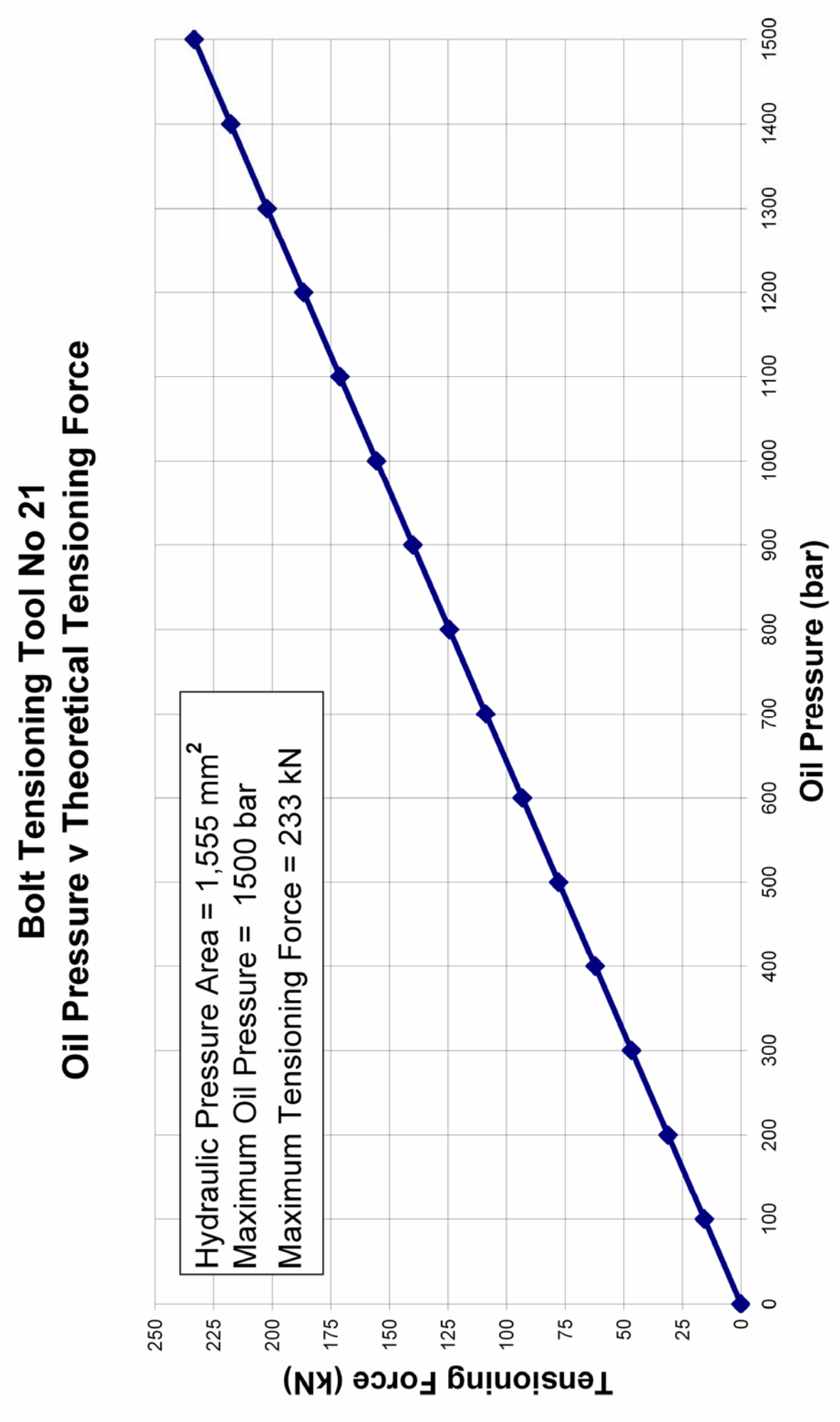
One graph shows the theoretical tensioning force developed by the tool against the oil pressure applied.

The next graphs show the initial bolt stress developed by the tool against the oil pressure applied for each bolt size. This graph is provided to assist with the check that the tensioning force does not exceed 90% of the yield strength of the bolt material.

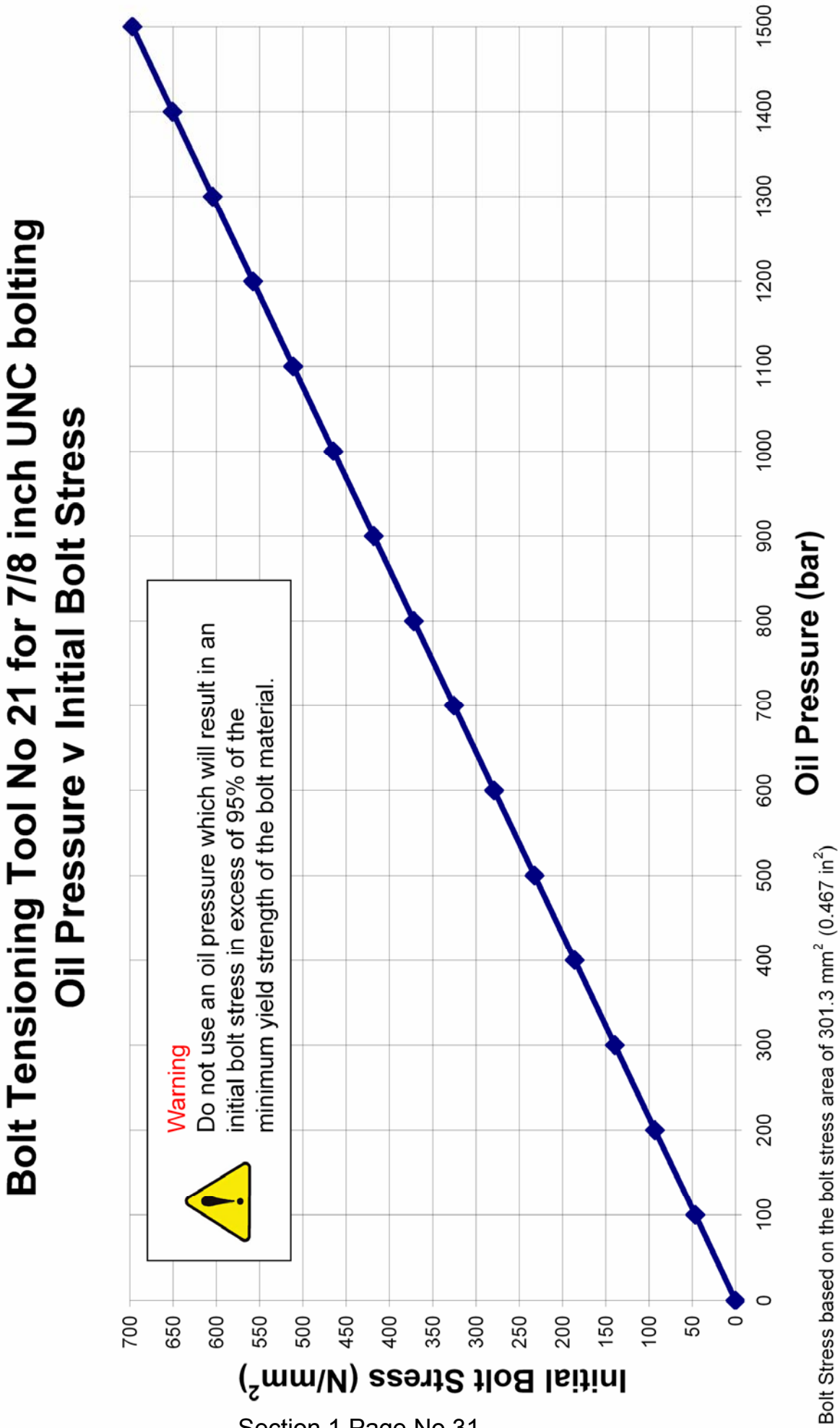
Users who require highly accurate residual bolt stresses should perform a bolt extension measurement before and after tensioning. In this way residual bolt stresses can be calculated from the actual bolt extensions measured.

TABLE OF OIL PRESSURE GRAPHS

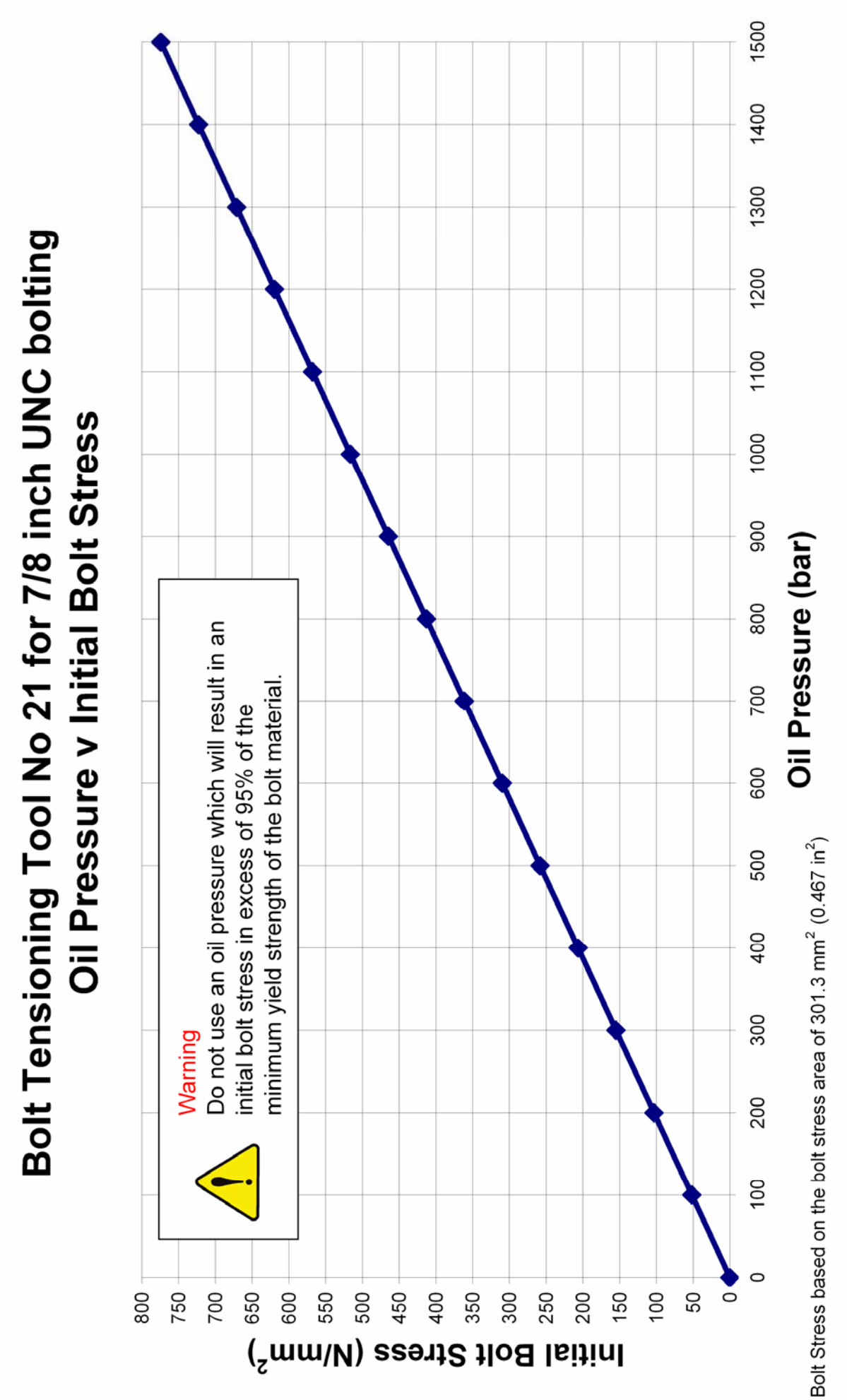
Graph TRM 21.L



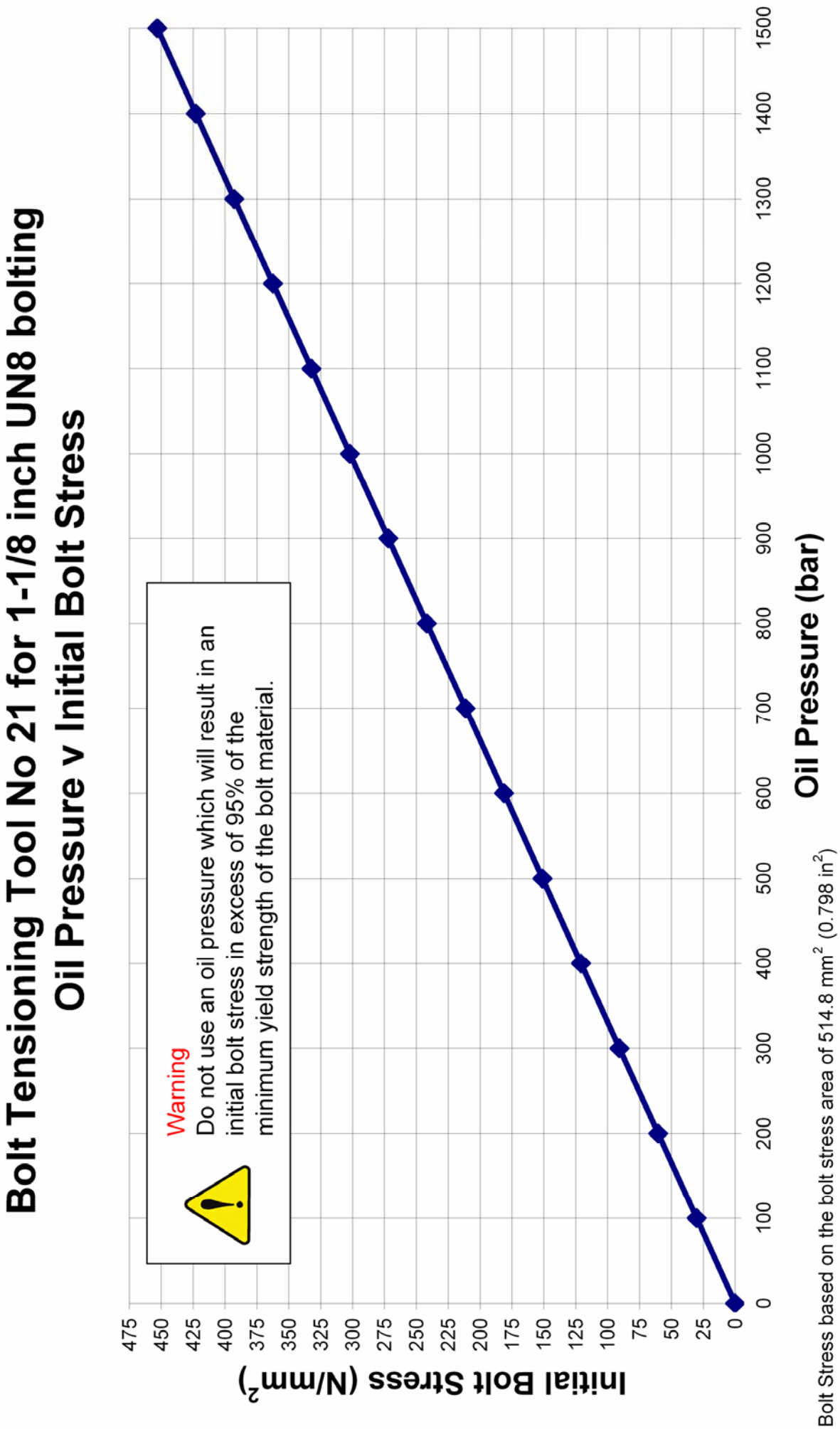
Graph TRM 21.0875



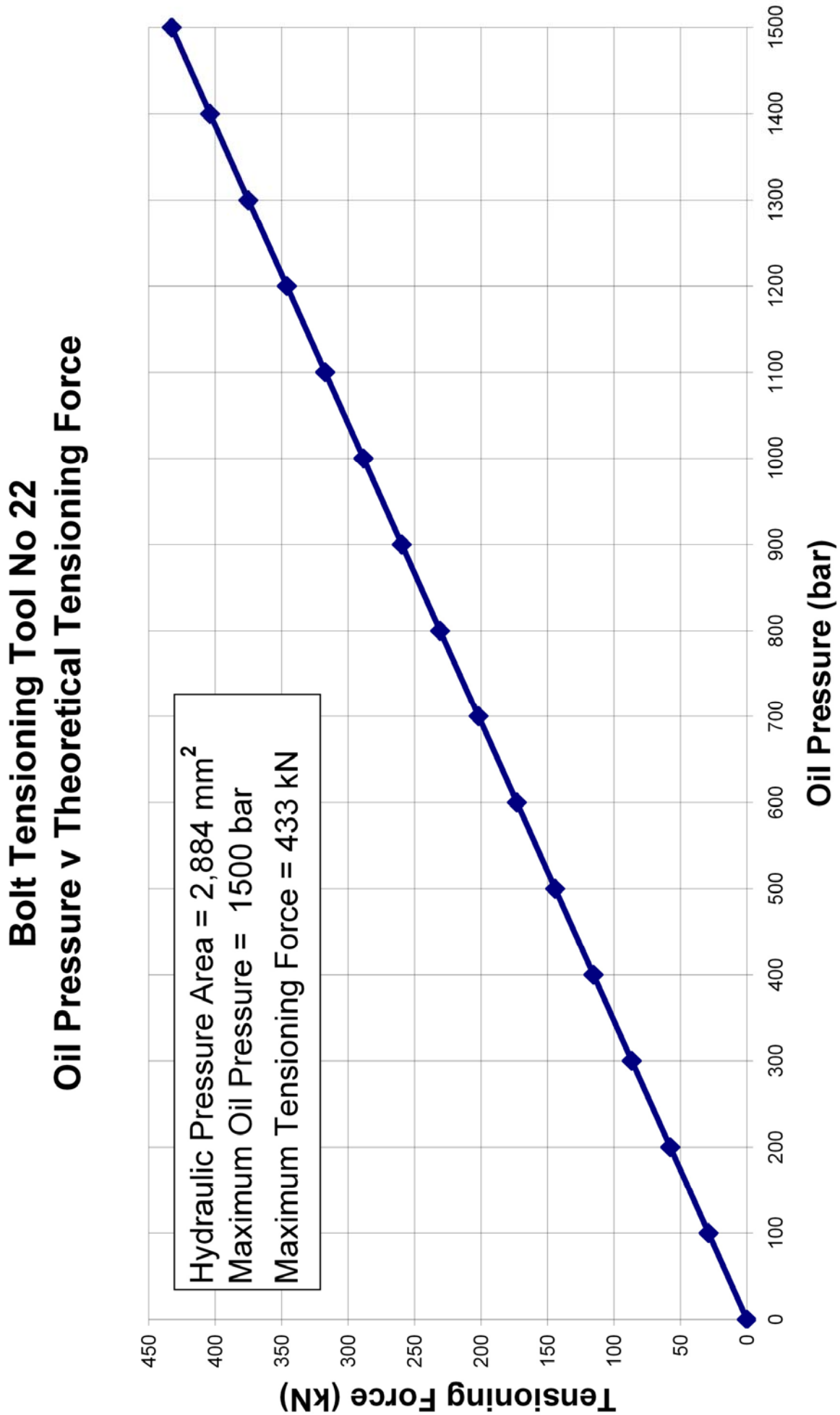
Graph TRM 21.1000



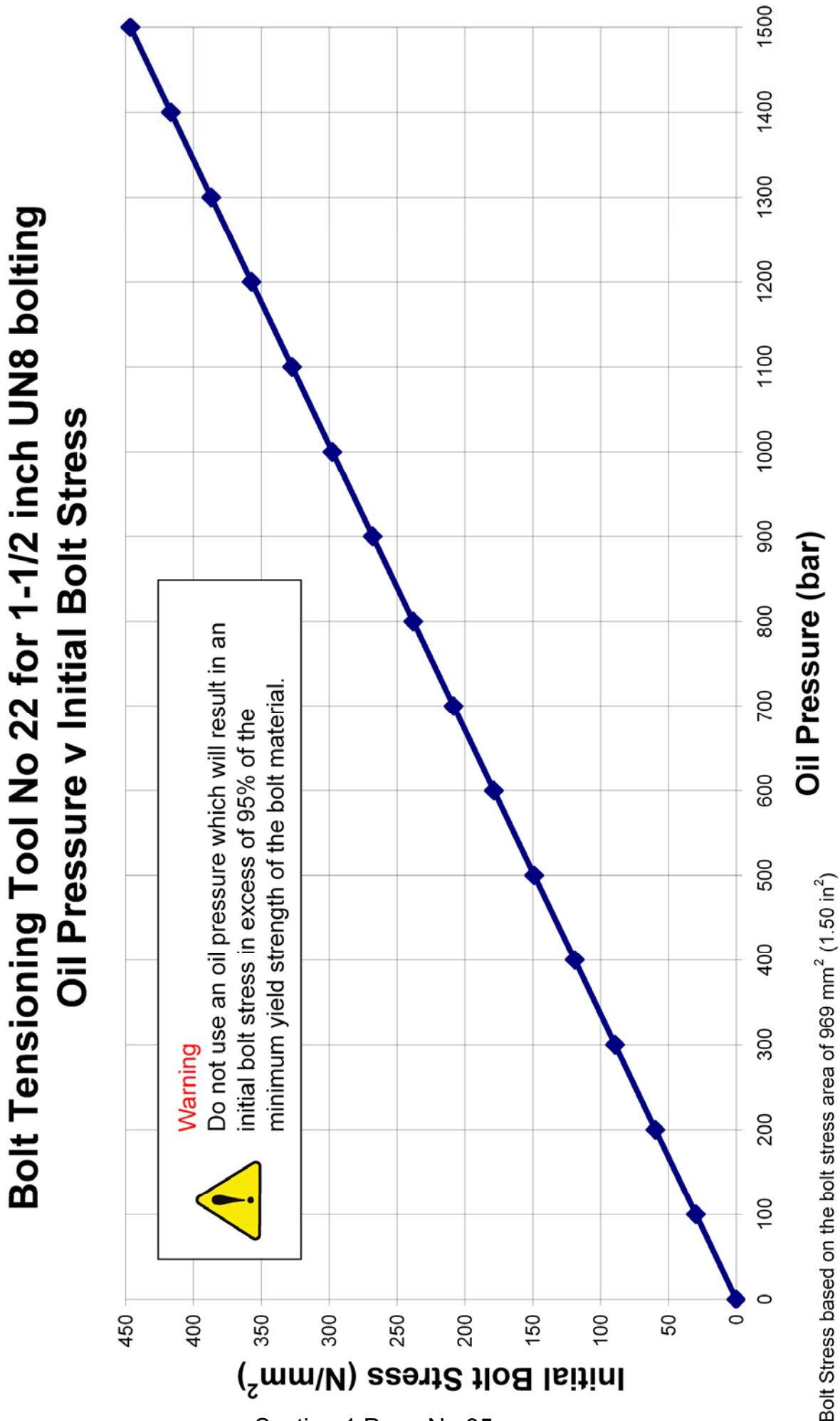
Graph TRM 21.1125



Graph TRM 22.L



Graph TRM 22.1500



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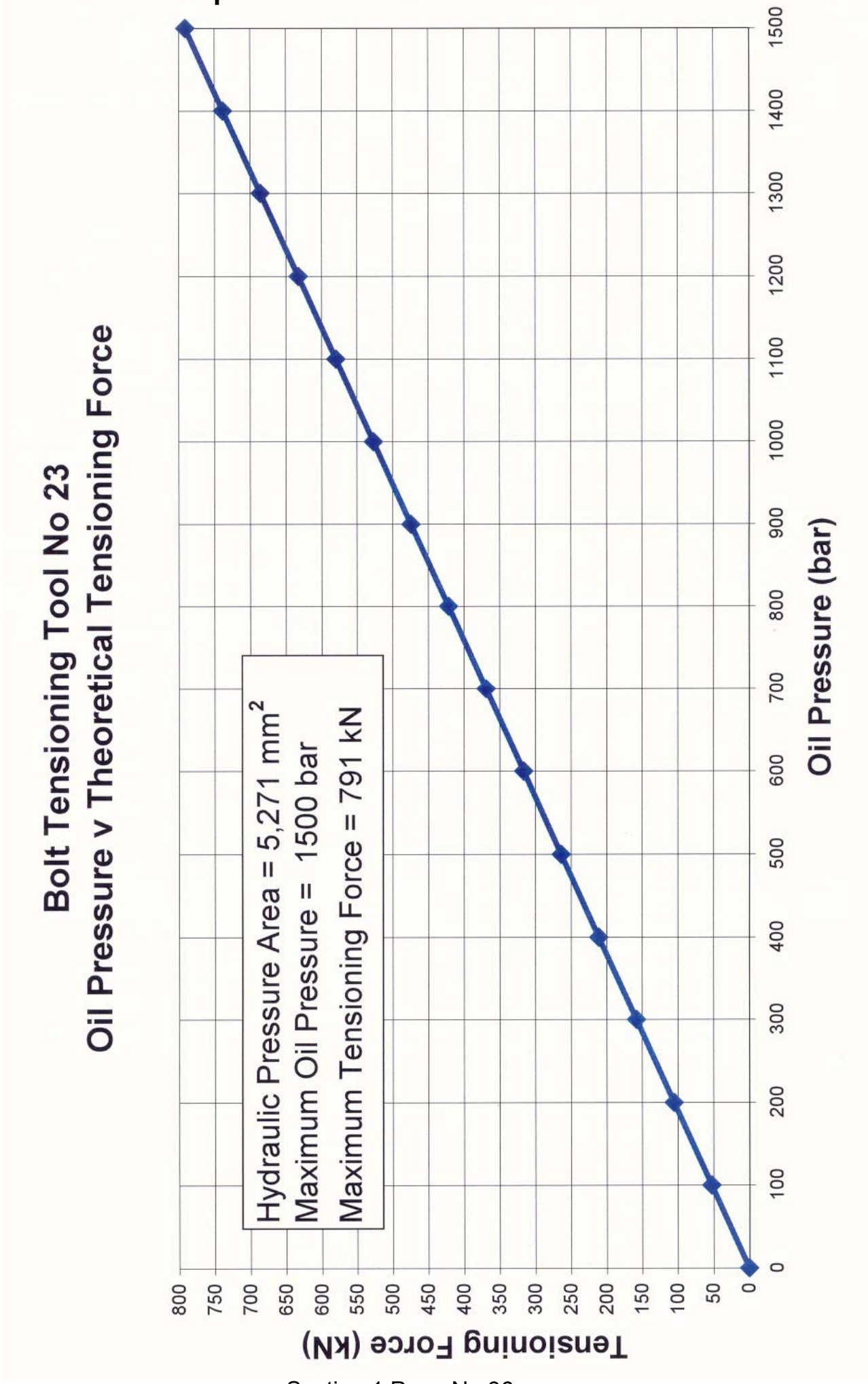
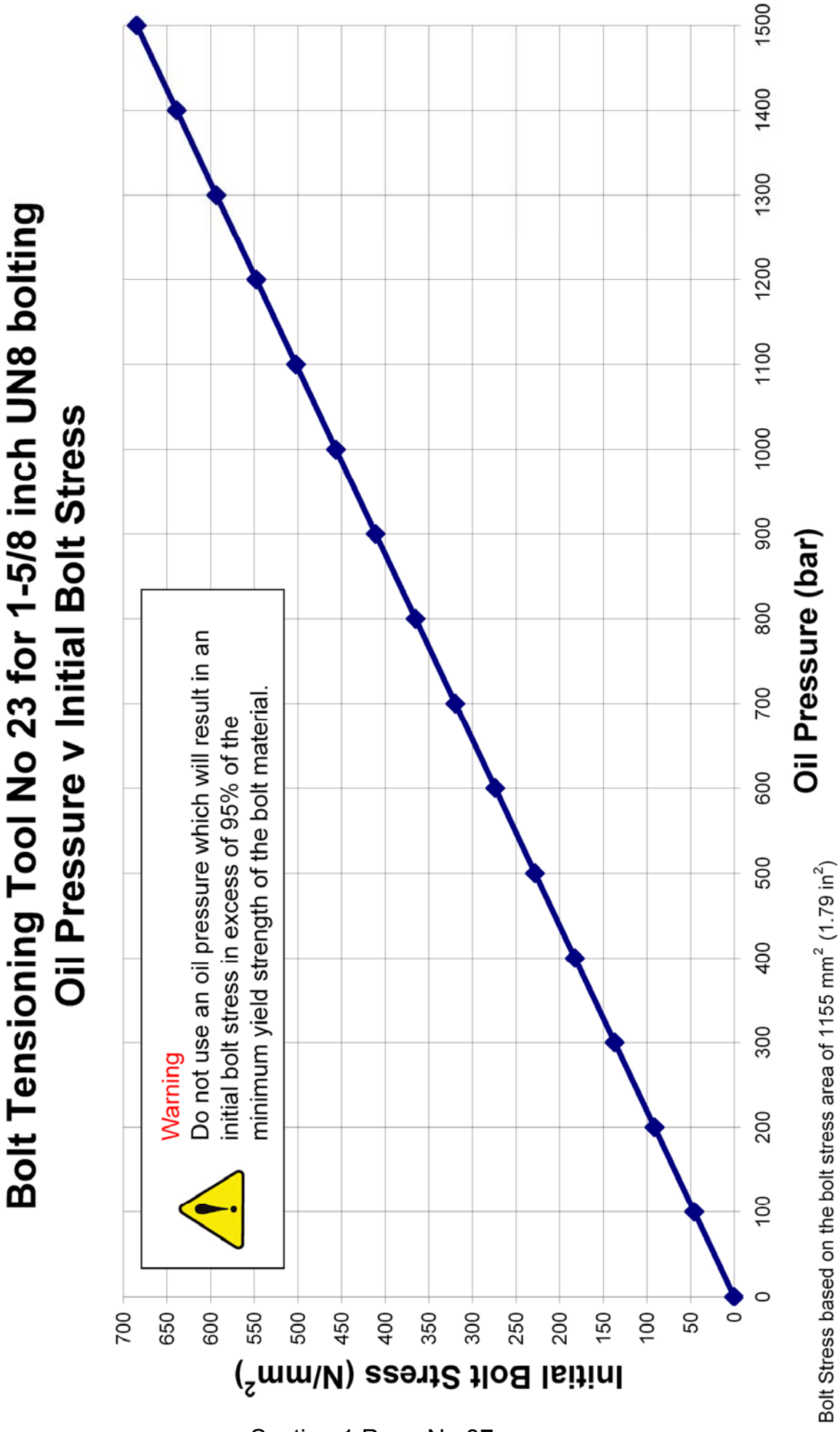
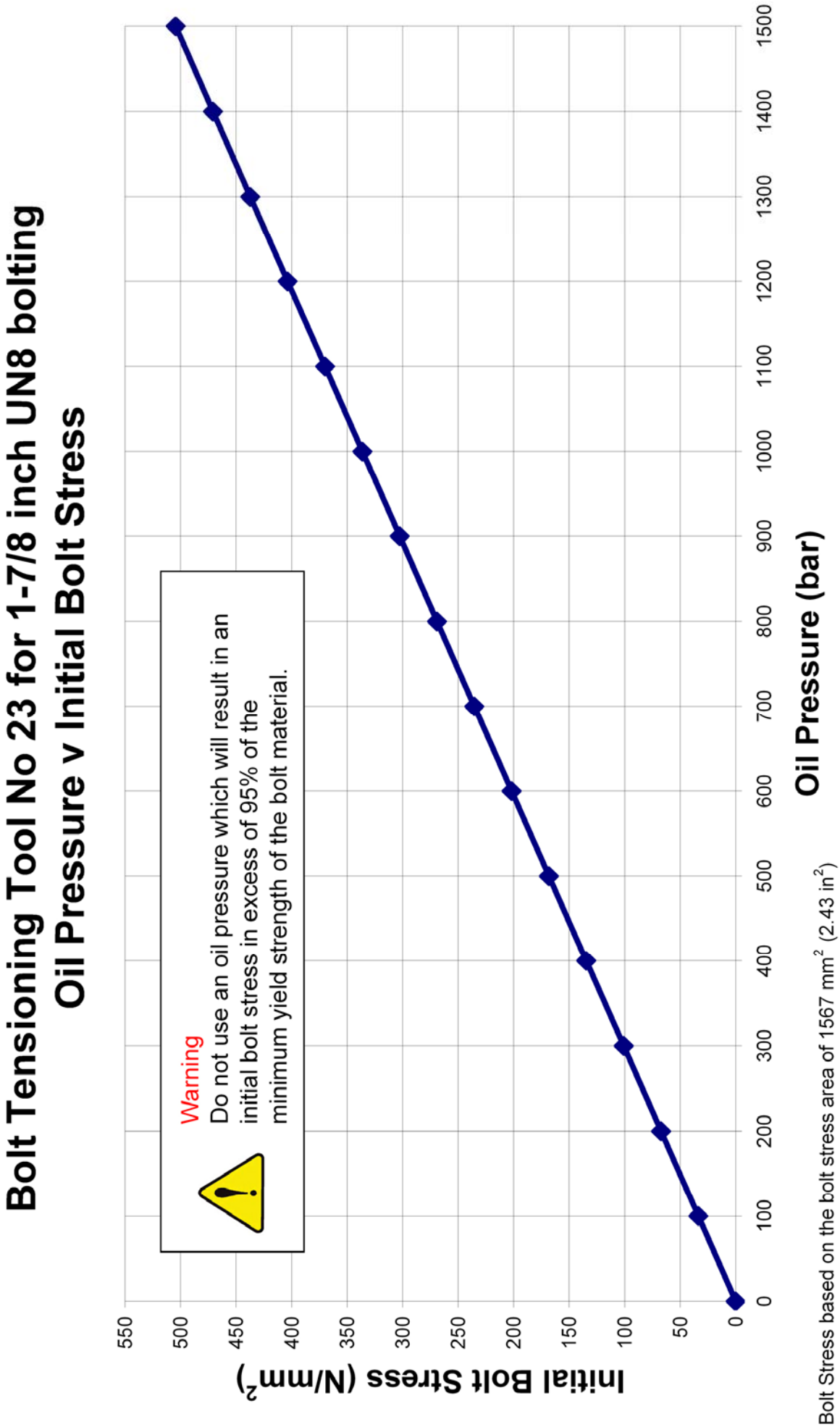


Graph TRM 23.1625



Graph TRM 23.1875



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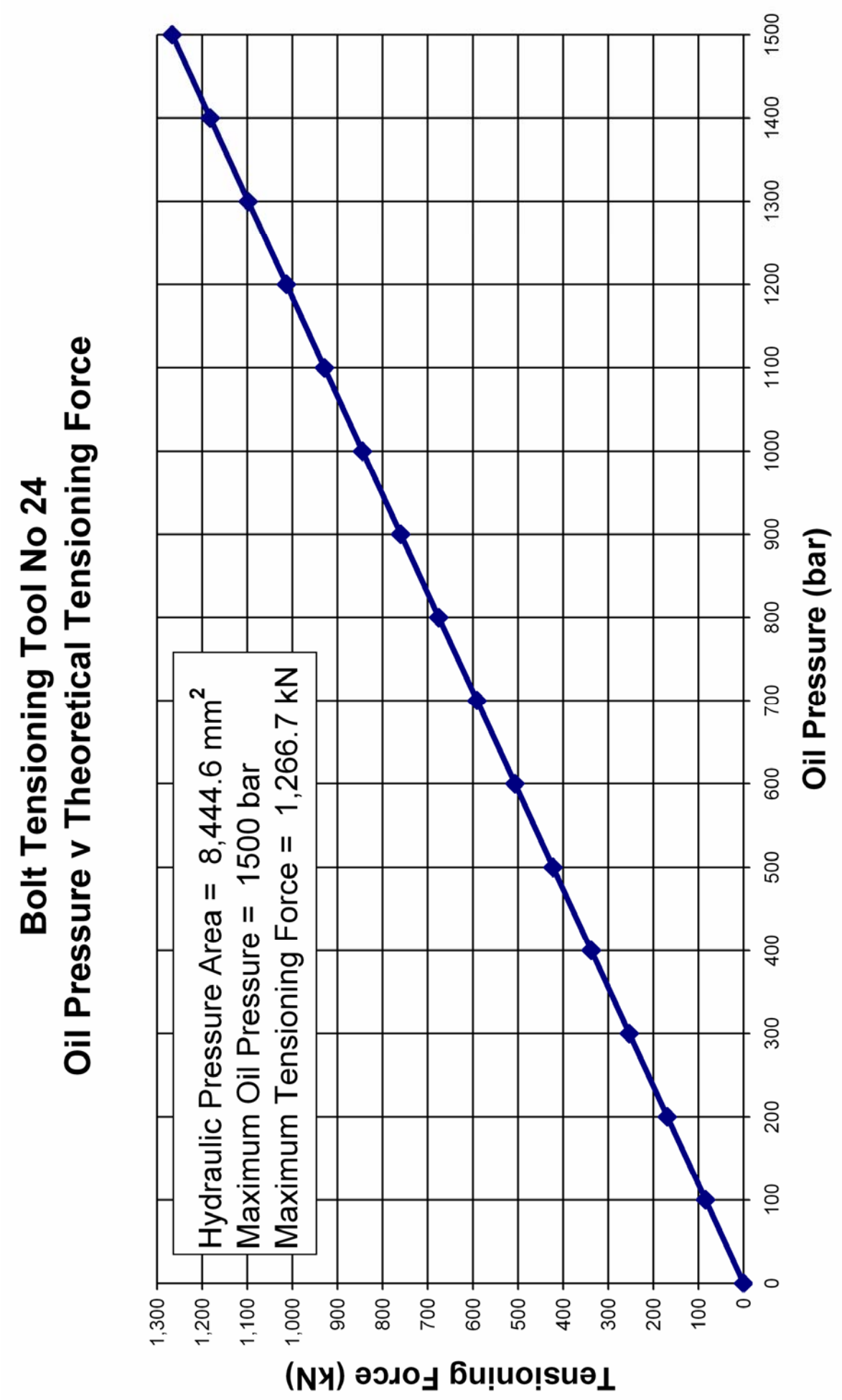

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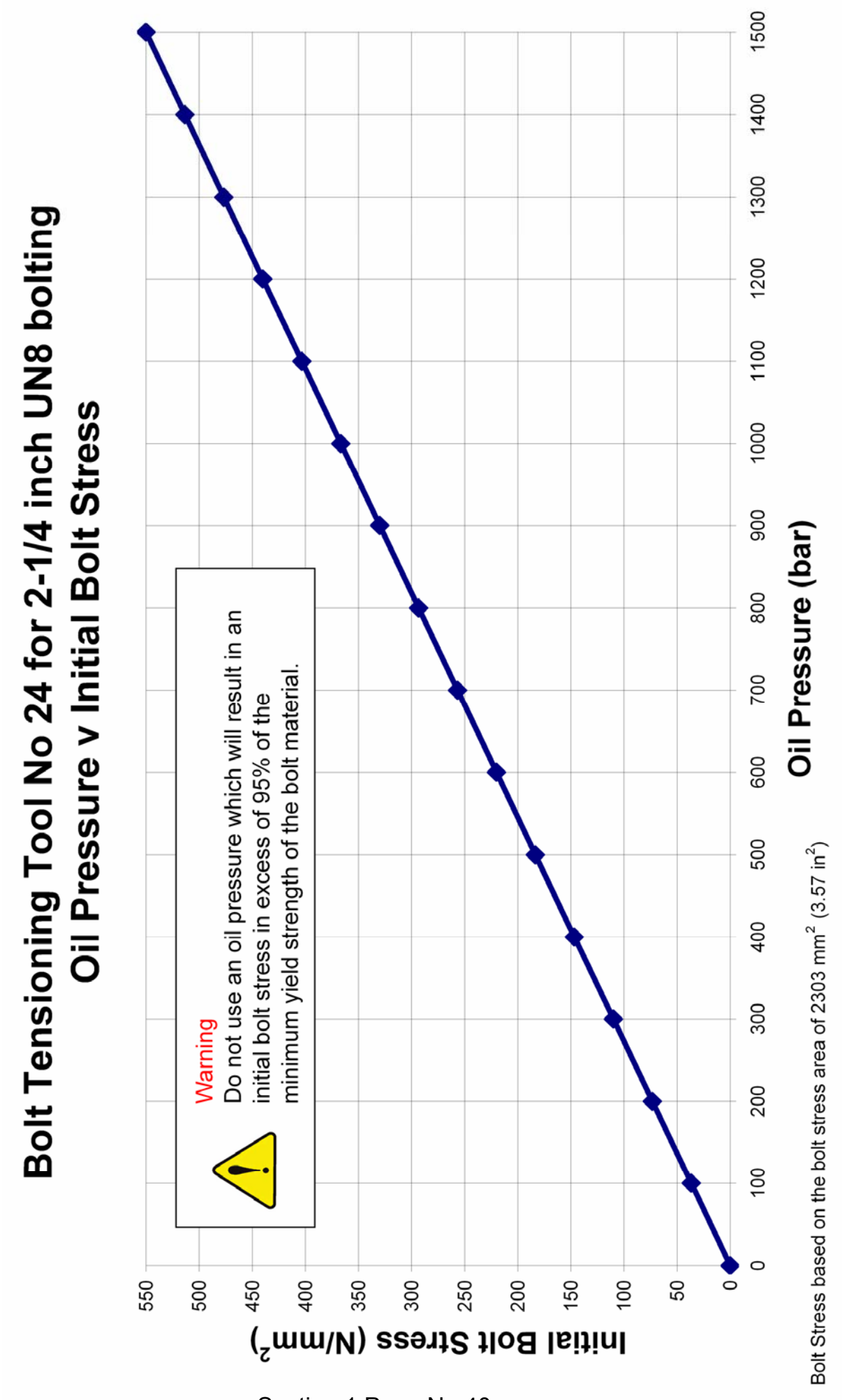
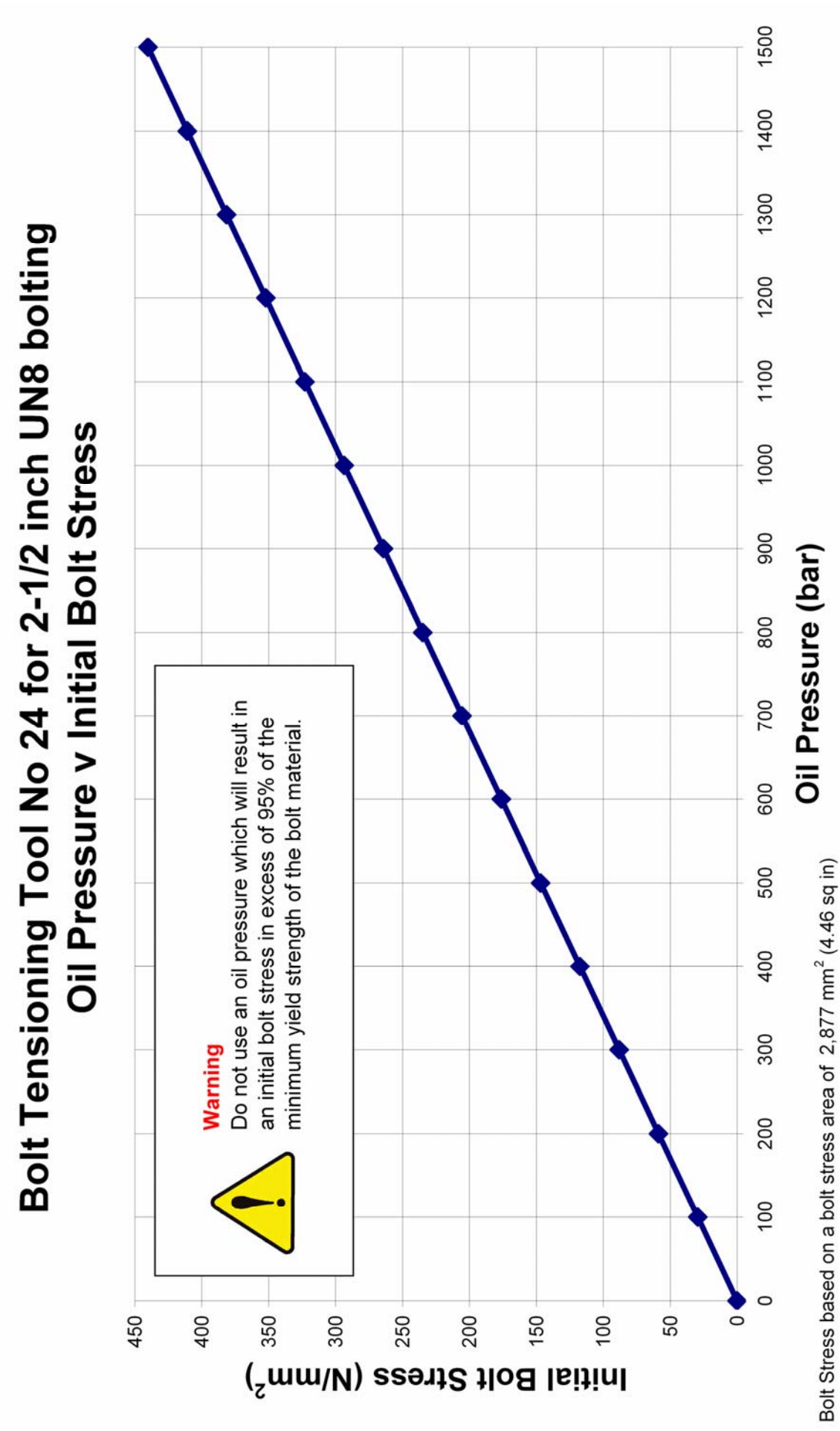
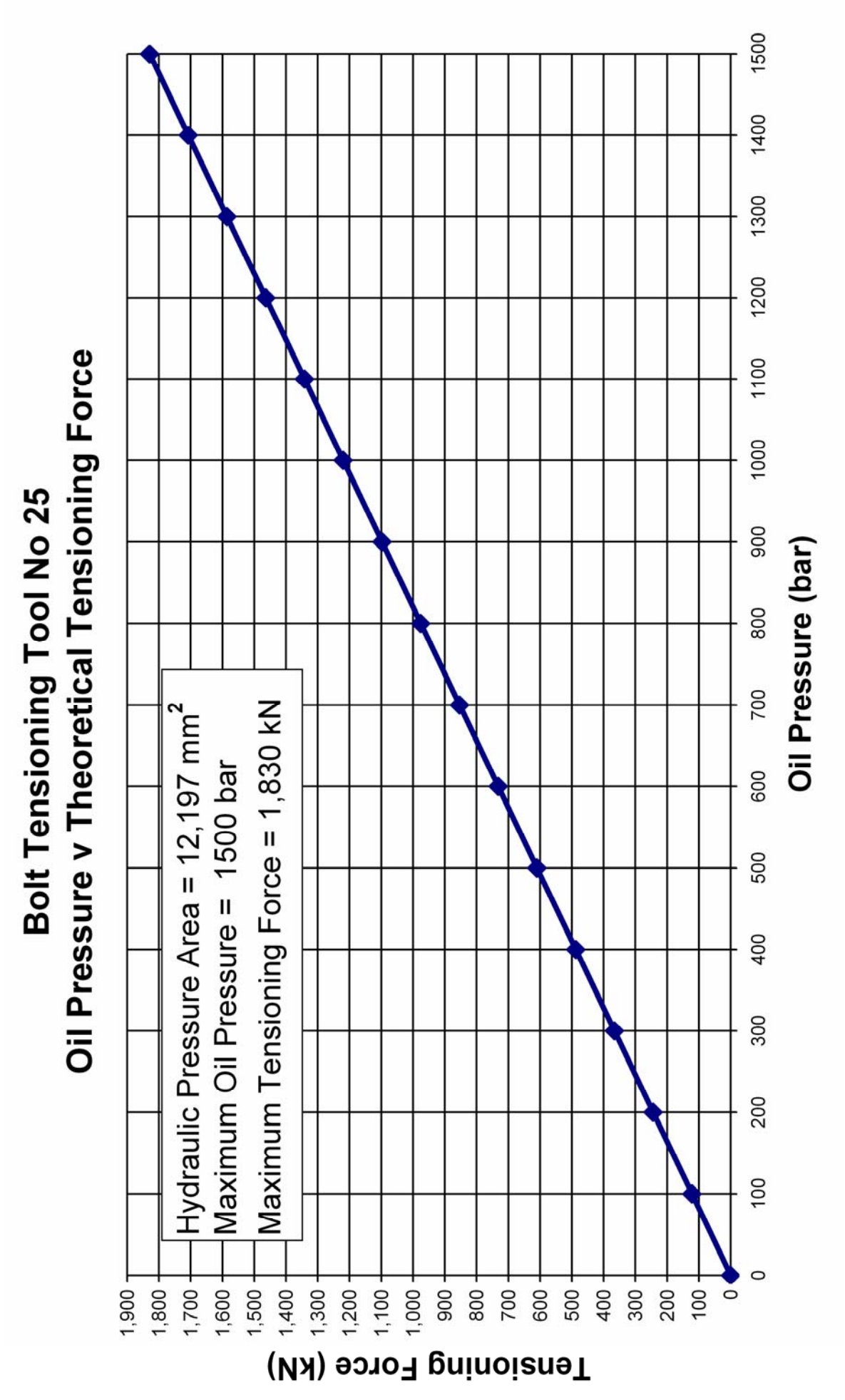


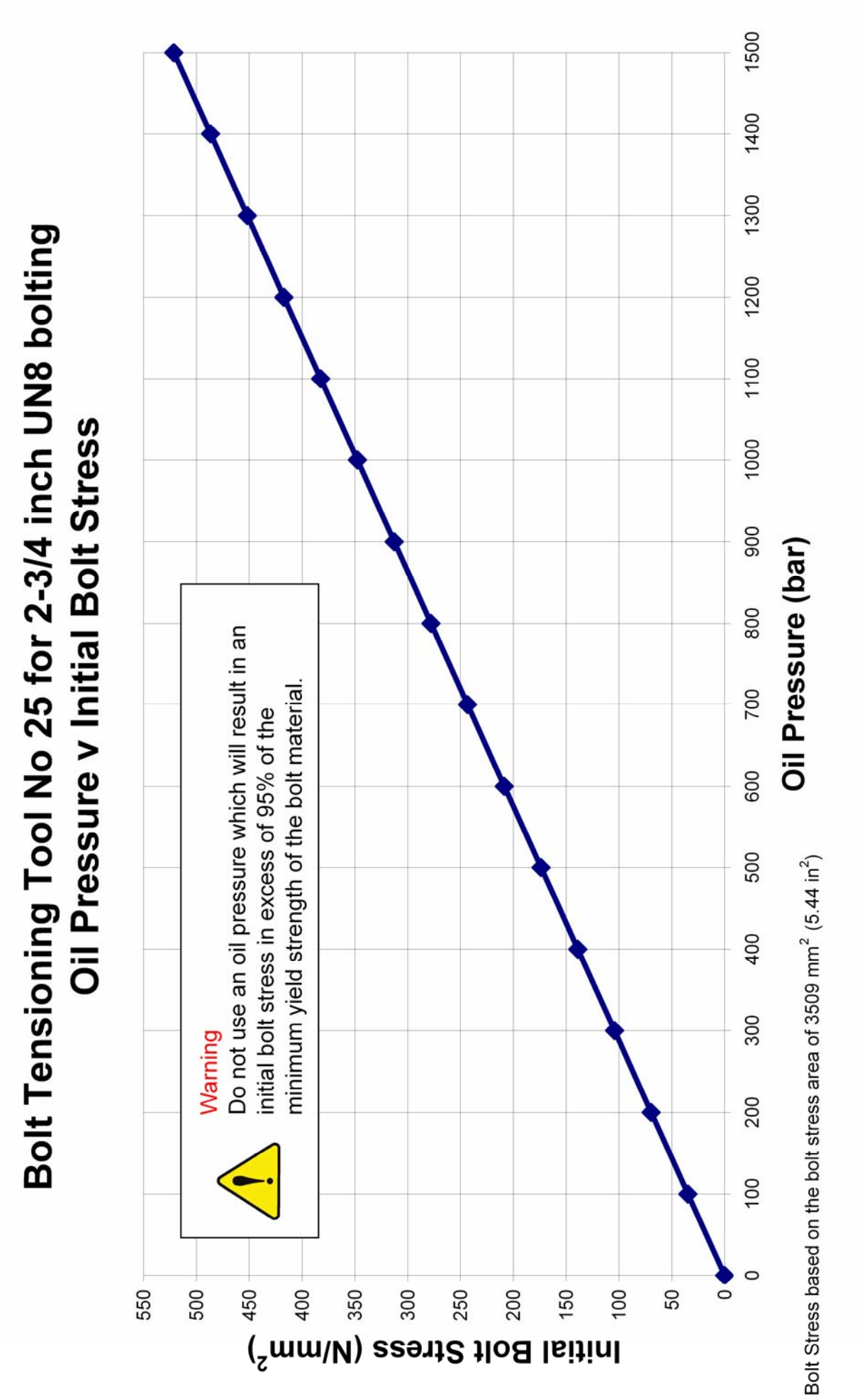
Graph TRM 24.2500



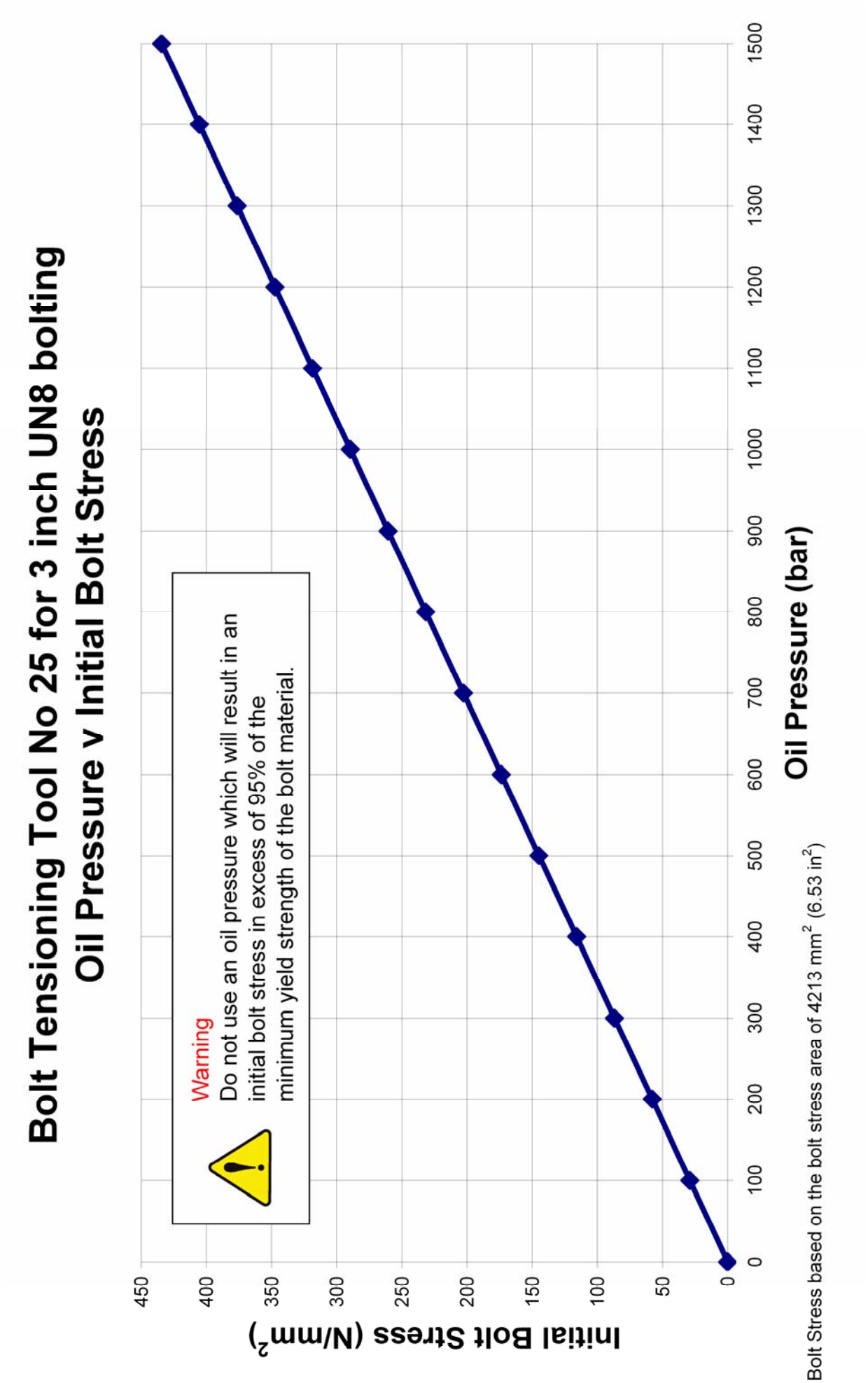
Graph TRM 25.L



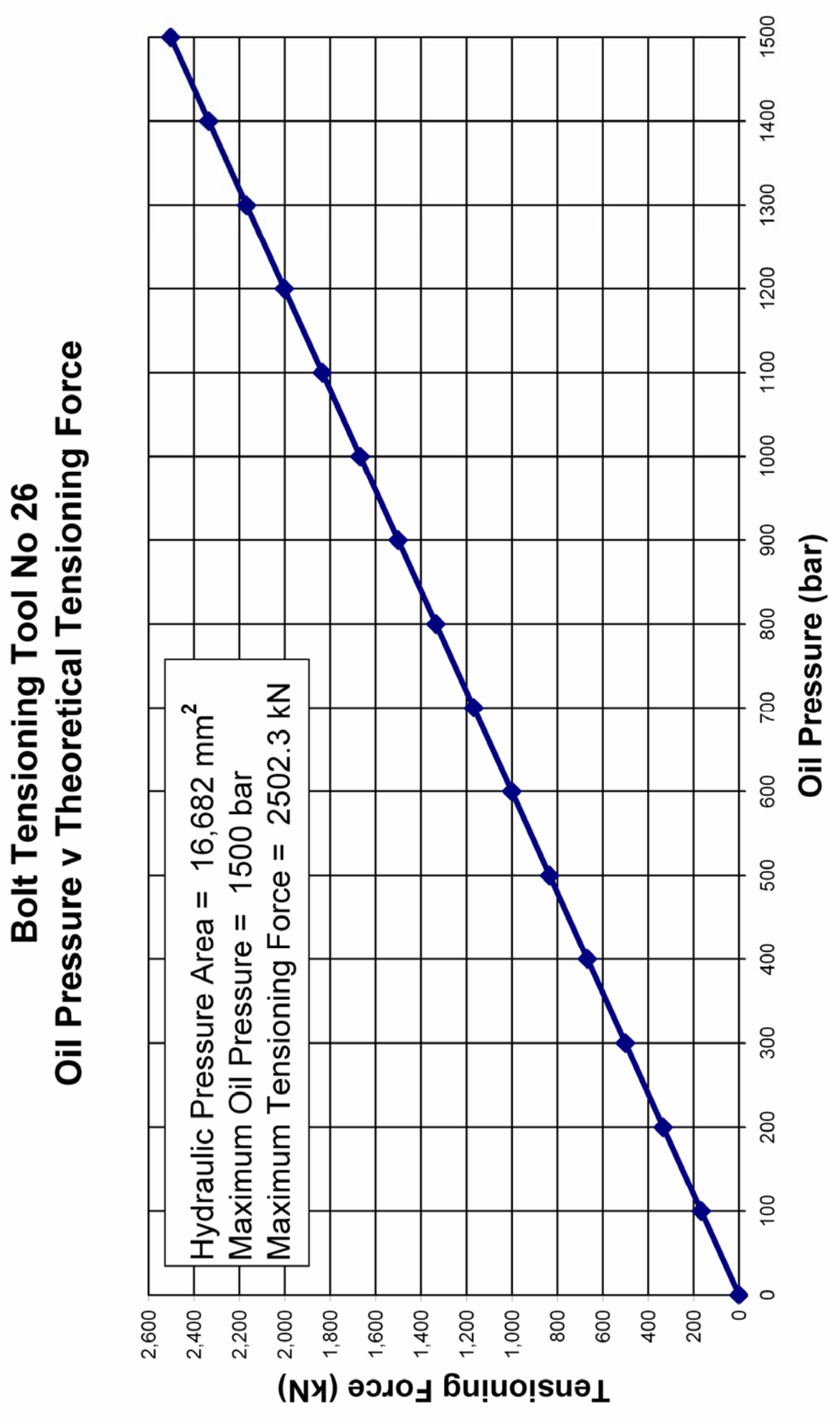
Graph TRM 25.2750



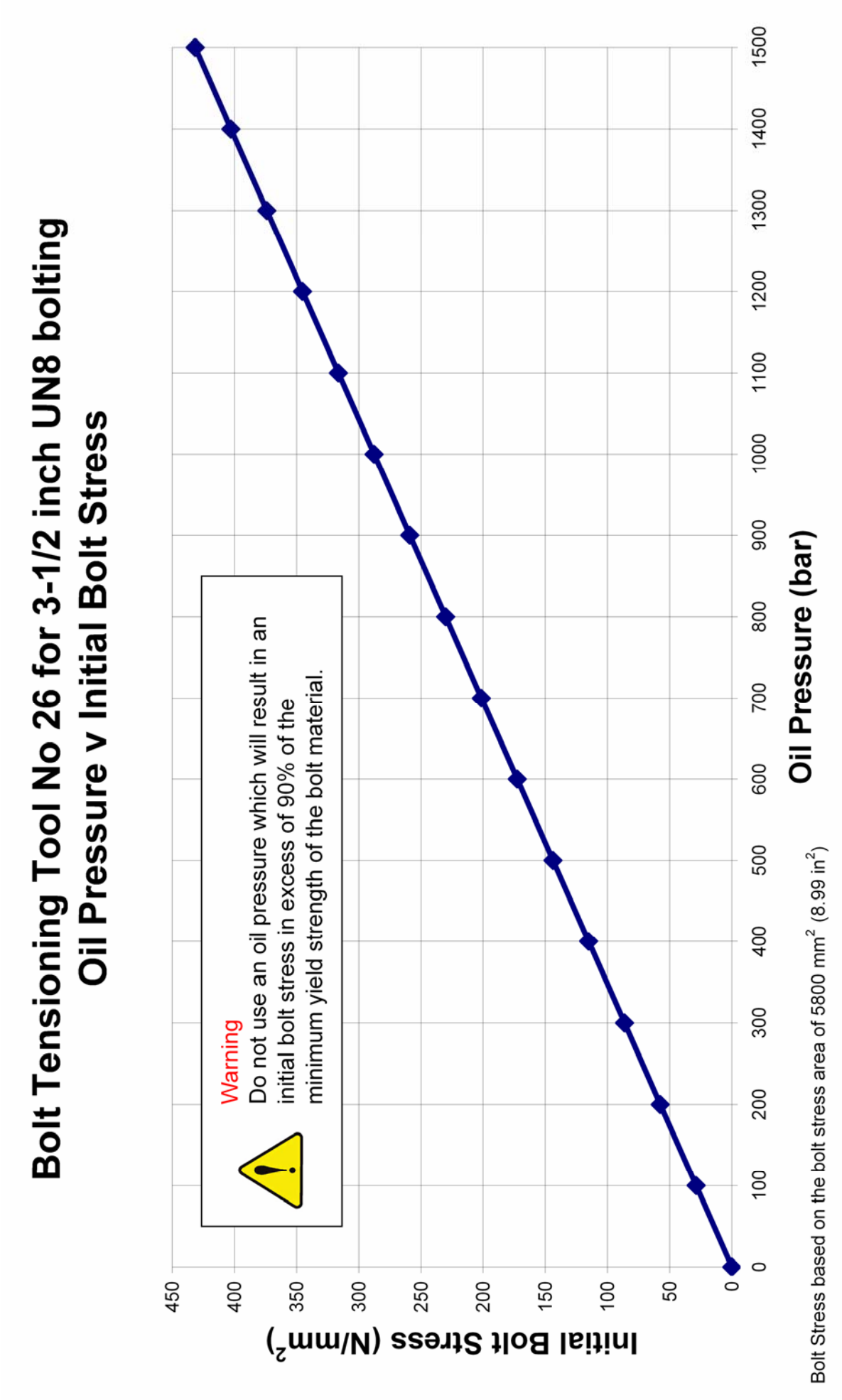
Graph TRM 25.3000



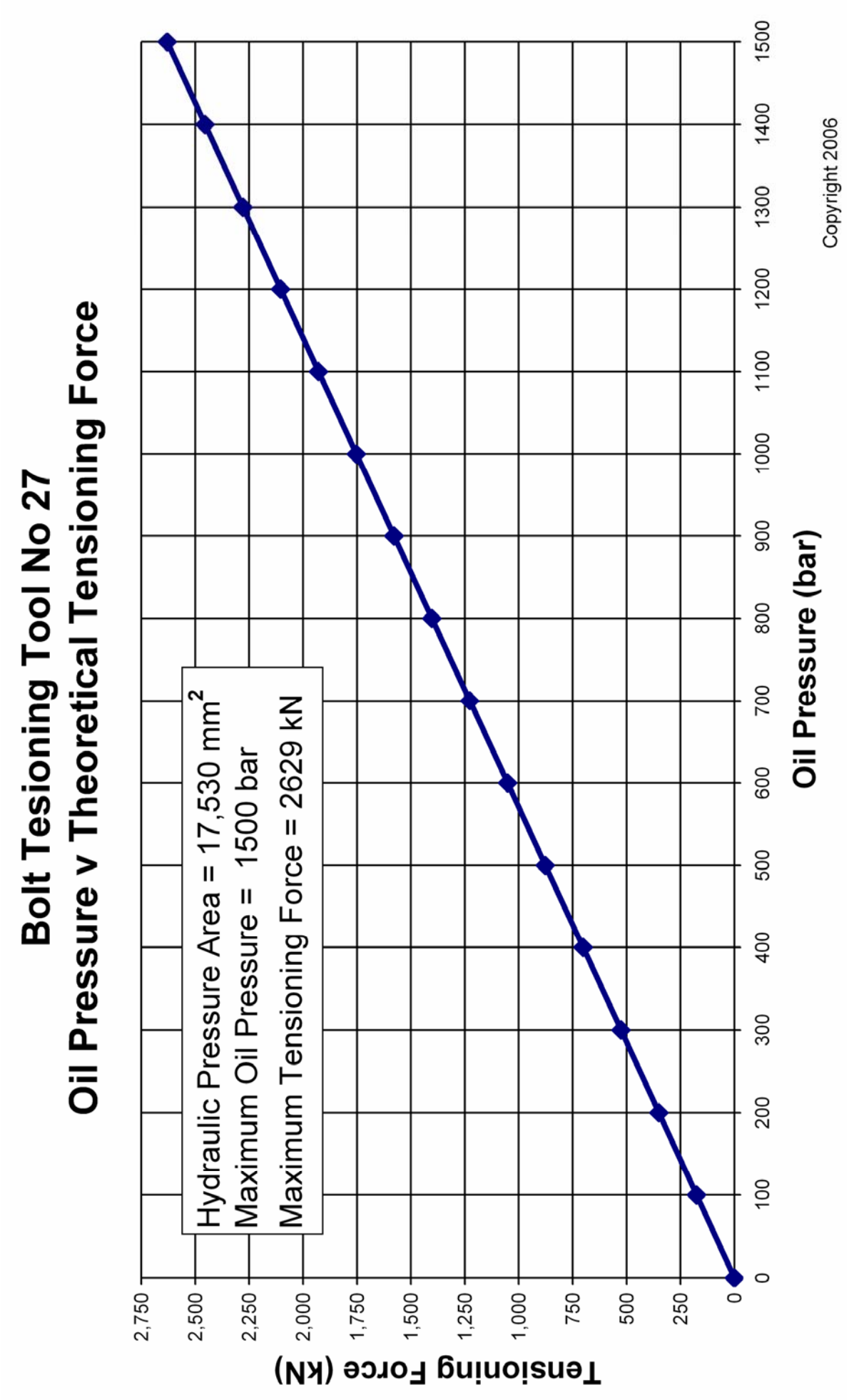
Graph TRM 26.L



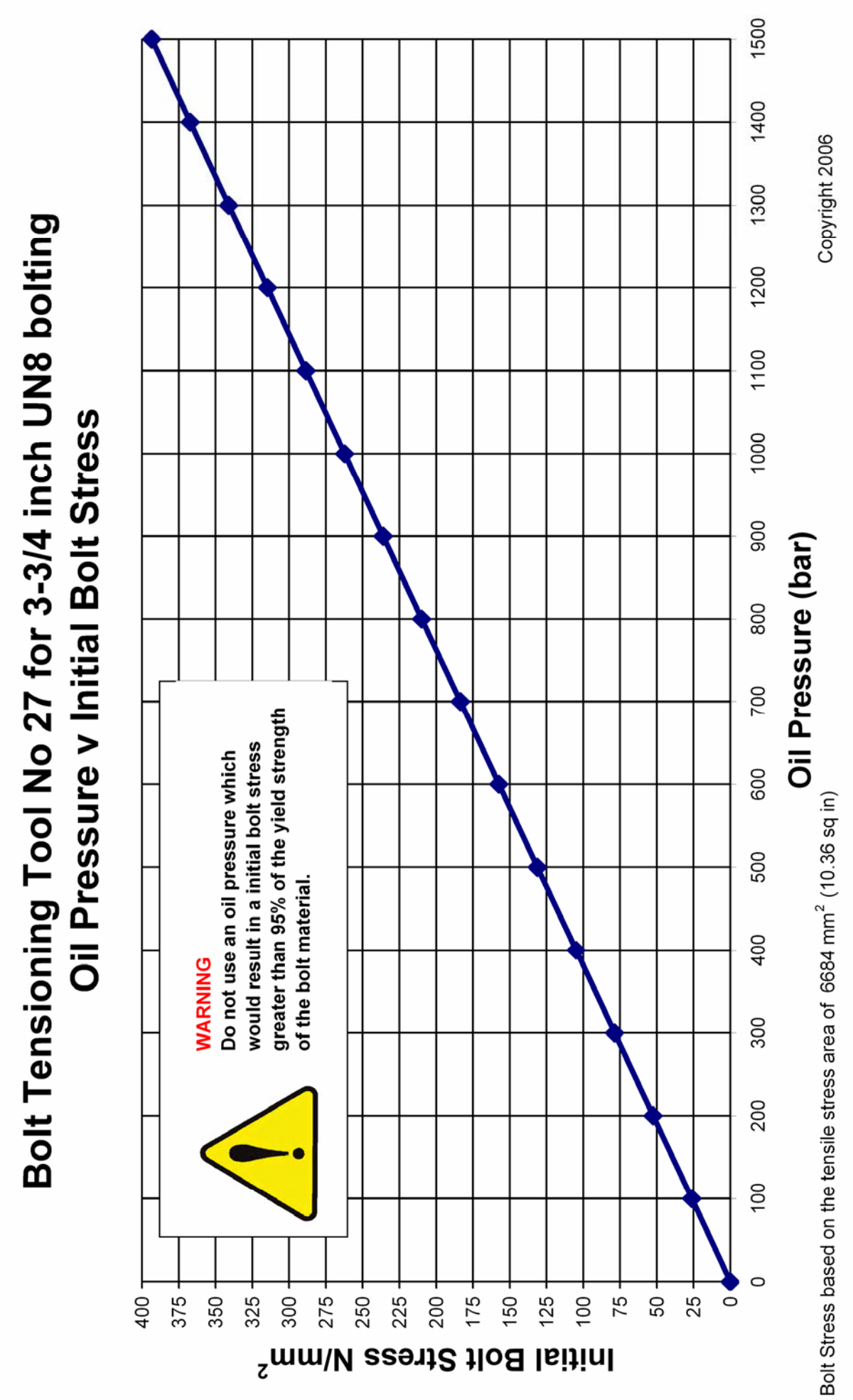
Graph TRM 26.3500



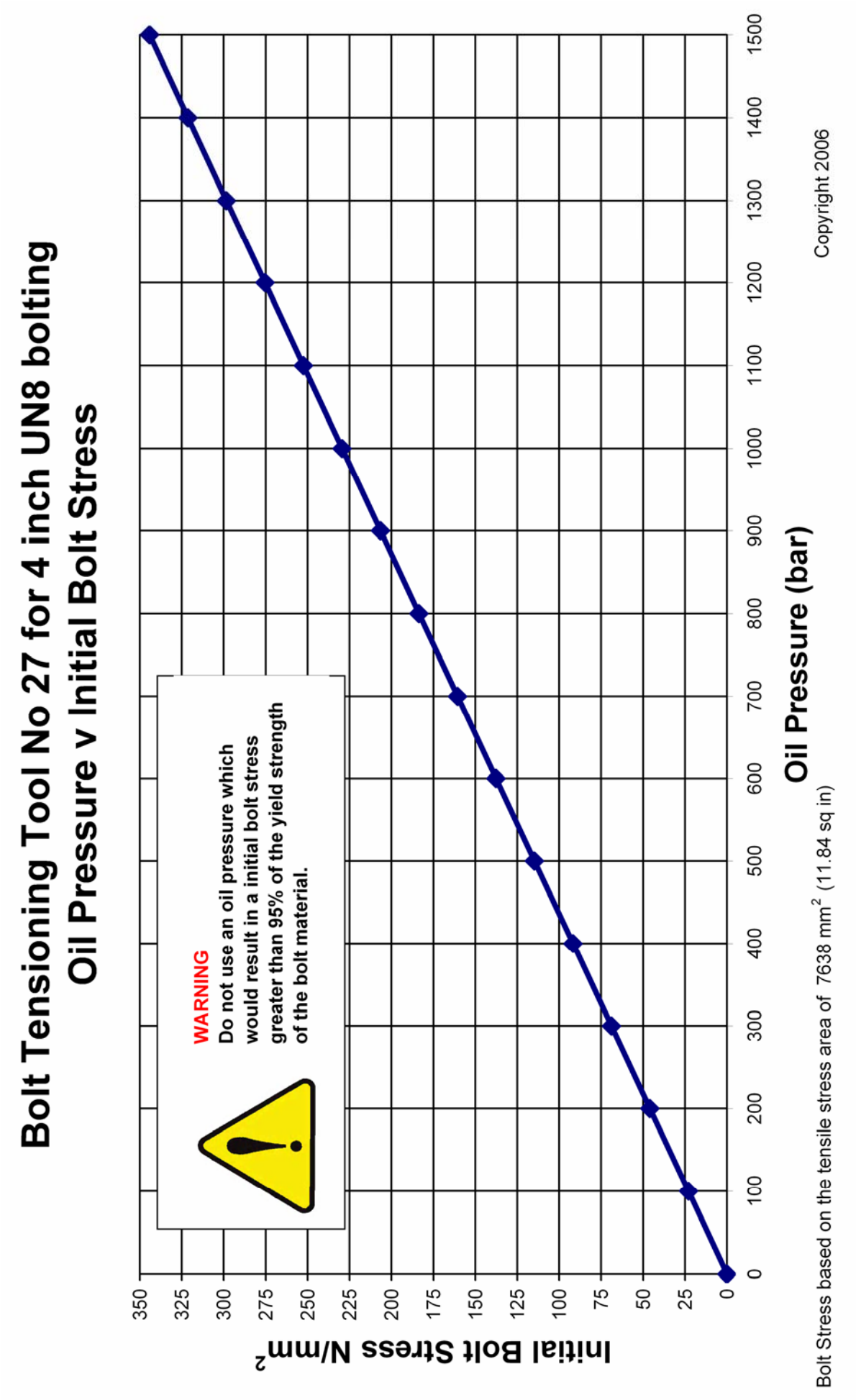
Graph TRM 27.L



Graph TRM 27.3750



Graph TRM 27.4000



SECTION 2

HEALTH & SAFETY INSTRUCTIONS

Persons using hydraulic bolt tensioning tools must read and understand this section before starting to use the equipment. Your attention is particularly drawn to the instructions in RED on Page 2 and Page 7

THINK SAFETY

HEALTH & SAFETY INSTRUCTIONS

IMPORTANT NOTICE

Thank you for purchasing or renting your hydraulic bolt tensioning equipment from **TITAN**. Bolt tensioning tools are very powerful and capable of inducing very high bolt stresses. This equipment has been designed to give many years of safe tightening of bolted connections when used in accordance with these instructions.

Persons using hydraulic bolt tensioning tools must be properly trained in the correct use of the equipment and must take adequate steps to ensure their own safety, and the Health and Safety of others working in the area where bolt tensioning operations are being performed. **TITAN** will be pleased to quote for the provision of training courses either at its base or on site anywhere in the world.

Operators must read all of this instruction and maintenance manual before attempting to use the equipment. Do not use the equipment if you are not already an experienced user of hydraulic bolt tensioning tools or if you have not already received proper training. Your attention is particularly drawn to the notes in **RED**.

Tightening a bolt with a hydraulic bolt tensioning tool is like lifting a heavy weight with a crane or lifting a car with a hydraulic jack. Everyone knows it is not safe to stand underneath a load on a crane or to work under a car supported only by a jack. However, not everyone will immediately know that standing in line with the long axis of a bolt, during the bolt tensioning operation, is the same as standing under a weight during a lifting operation or working under a car supported only by the jack.

When using bolt tensioners, loads of many hundreds of tonnes and even thousands of tonnes can be induced. If the bolt material is incorrect or faulty or the tool is incorrectly installed, the broken bolt, could be launched at high speed along the axis of the bolt. This is a very rare occurance. However if there is a failure, anyone standing near to the bolt tensioning tool or in line with the axis of the bolt during the tensioning operation will suffer critical injury or even be killed. It is therefore essential that anyone operating this equipment is properly trained in its safe use and takes every precaution to ensure that nobody is allowed to stand, work or stray near to or into line with the axis of any bolt tensioning tool during the bolt tensioning operation.

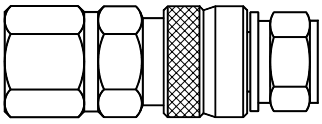
Bolt tensioning tools are powerful and use high pressure hydraulics it is essential that you are trained in the correct use of the equipment and adhere fully with the Health and Safety Instructions.

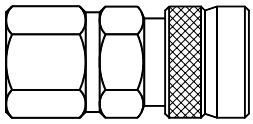
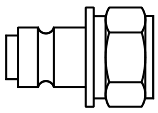
HEALTH & SAFETY INSTRUCTIONS

Quick Connectors

DO NOT pressurise the connectors when they are disconnected

Check there is no pressure in the system before attempting to connect or disconnect the couplings.



Hoses

The flexible hydraulic hoses supplied by **TITAN** have a small plastic core tube surrounded by multiple high tensile steel spiral windings. The outside of the hose is moulded with a coloured plastic coating. Most hoses are also given a clear plastic cover to provide additional protection against damage when in use. Each hose is identified with a serial number. All hoses are pressure tested when manufactured and test certificates can be issued.

TITAN supplies three types of high pressure flexible hydraulic hose and they are easily identified by the colour of the moulded plastic coating beneath the clear plastic cover. The maximum working pressure for the hose is sometimes marked on the outside of the coloured plastic coating, however this is the working pressure of the hose ONLY and not the hose ASSEMBLY. The maximum working pressure of a hose assembly is often limited by the pressure rating of the quick connect couplings and/or the fittings on the end of the hose. Although the hose may be capable of operating at higher pressures the limit you must observe is shown below along with the minimum bend radius.

Colour	Max Working Pressure	Min Bend Radius
GREEN	1000 bar	95 mm
BLUE	1500 bar	130 mm
RED	2500 bar	200 mm

Each type of hose is fitted with self sealing quick connect couplings at one or both ends.

HEALTH & SAFETY INSTRUCTIONS

You must observe the following Health & Safety instructions when using hydraulic hoses.

- Discard and do not use any hose that does not have an identifying serial number
- Discard and do not use any hose that shows any sign of damage either :-

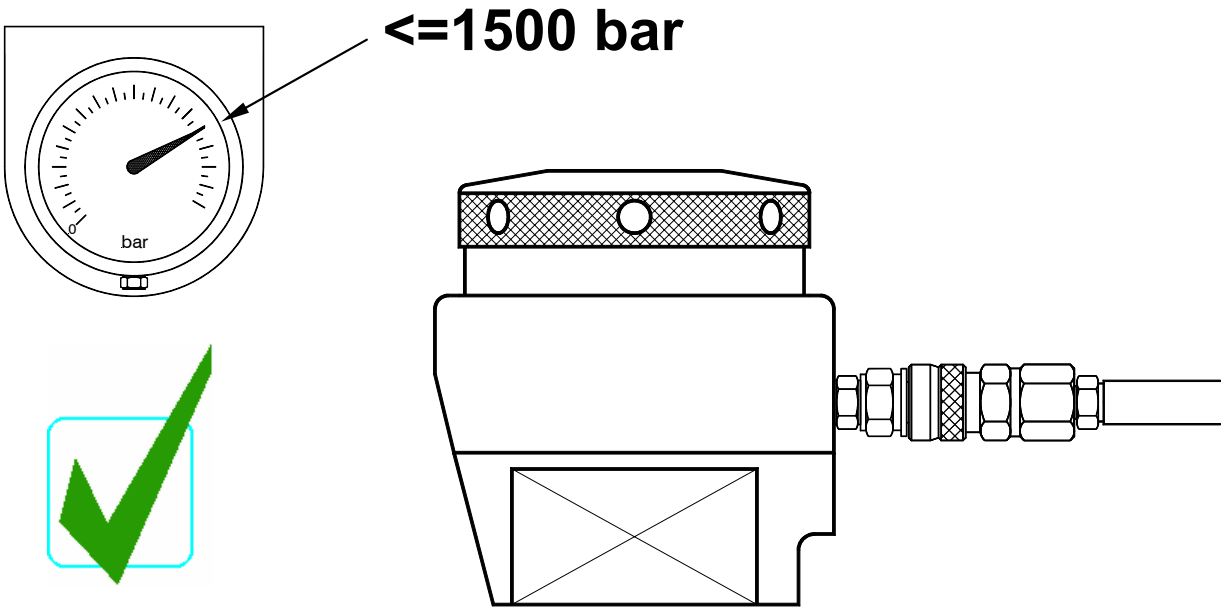
  a) to the coloured moulded plastic coating
  b) where the spiral windings are exposed
  c) where the spiral windings are damaged or broken
  d) where there is damage to the swaged metal ends
- Do not allow any hose to be kinked or knotted. Hoses which have been kinked or knotted will have suffered damage to the windings and must be discarded.
- Do not allow heavy objects to fall on, rest on, or roll over the hoses.
- Do not allow hoses to be subjected to temperatures higher than 60 deg C.
- Discard and do not use any hose which has been subjected to heat or fire.
- Do not bend the hose tighter than the minimum bend radius of the hose or it will be kinked.
- Do not exceed the maximum working pressure of 1000 bar for the GREEN colour hose, 1500 bar for BLUE colour hose, and 2500 bar for RED colour hose.
- Only use the hoses for their intended purpose – for use with **TITAN** hydraulic equipment.
- After use check the hoses for damage, wipe to remove dirt and oil, refit dust caps and prepare for storage.

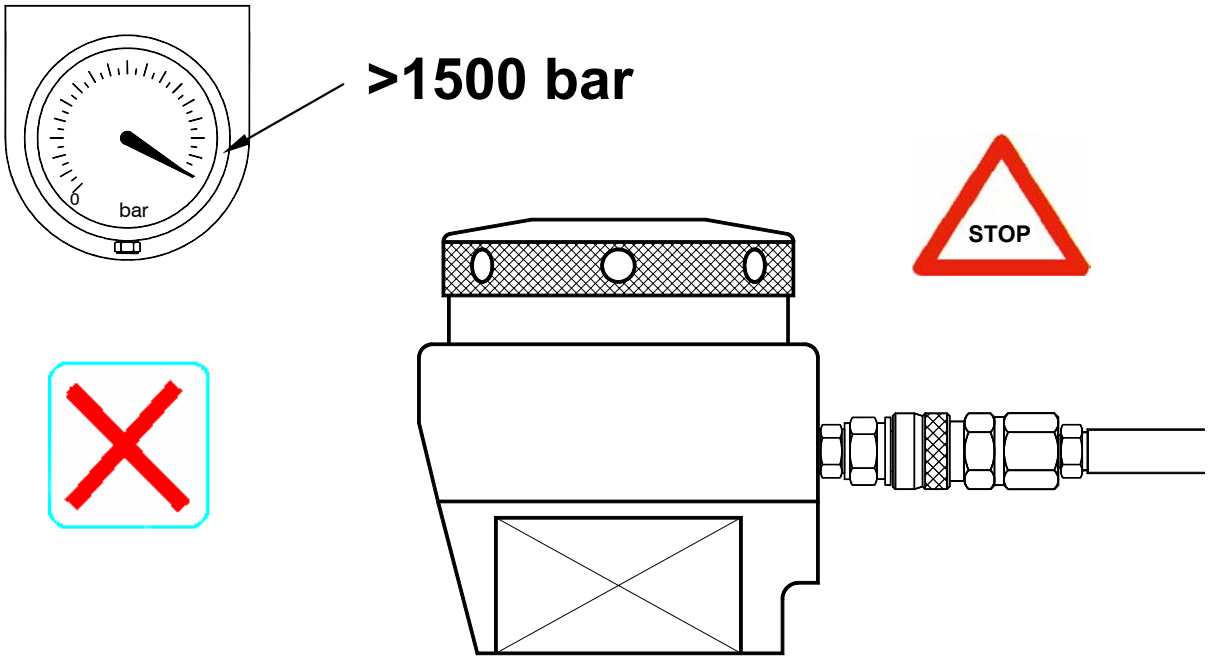
- When not in use store the hoses in a safe place where they cannot easily be damaged.
- Do not mix the GREEN, BLUE , RED colour coded hoses. The end fittings and quick disconnect couplings on these hoses have different pressure ratings.
- Never move hose end connectors or quick disconnects from BLUE hoses to any other colour hose.
- Never move hose end connectors or quick disconnects from RED hoses to any other colour hose.
- Never move hose end connectors or quick disconnects from GREEN hoses to any other colour hose.
- Use GREEN colour coded hoses for 1000 bar System Tools and Equipment.
- Use BLUE colour coded hoses for 1500 bar System Tools and Equipment.
- Use RED colour coded hoses for 2500 bar System Tools and Equipment.
- Check the bolt tensioning tools you are using are compatible with the hoses you are using. All **TITAN** tools are marked with the maximum operating pressure.
- Never pressurise a quick disconnect coupling or nipple when disconnected.
- Do not take apart any ring main harness component or hose assembly. These are filled with oil and pressure tested after assembly. When taken apart the integrity of the assembly is lost and the pressure test invalidated. Return any parts that need attention to TITAN where the correct specification parts will be used to effect repairs, followed by pressure testing and certification before return.

HEALTH & SAFETY INSTRUCTIONS

Bolt Tensioning Tools

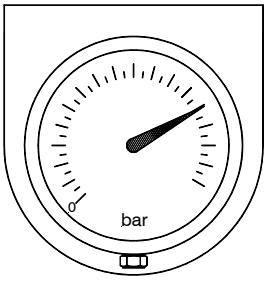
DO NOT exceed the 1500 bar Maximum Working Pressure





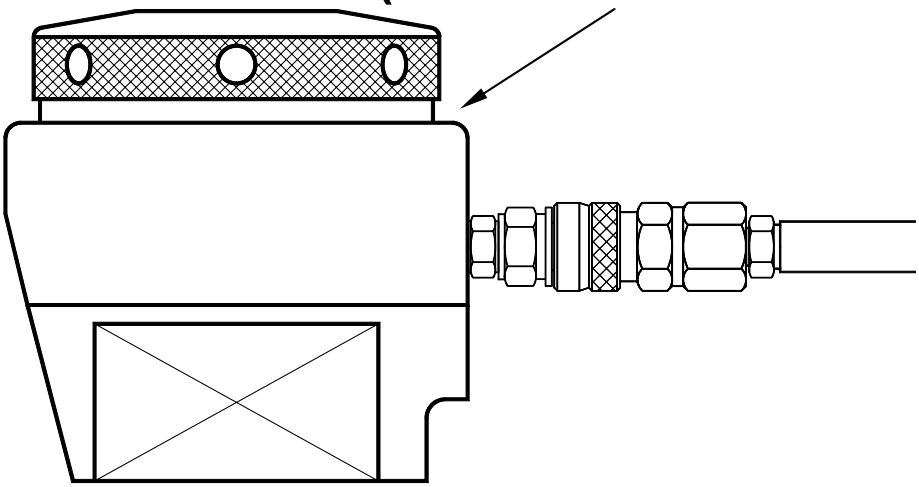
HEALTH & SAFETY INSTRUCTIONS

Bolt Tensioning Tools

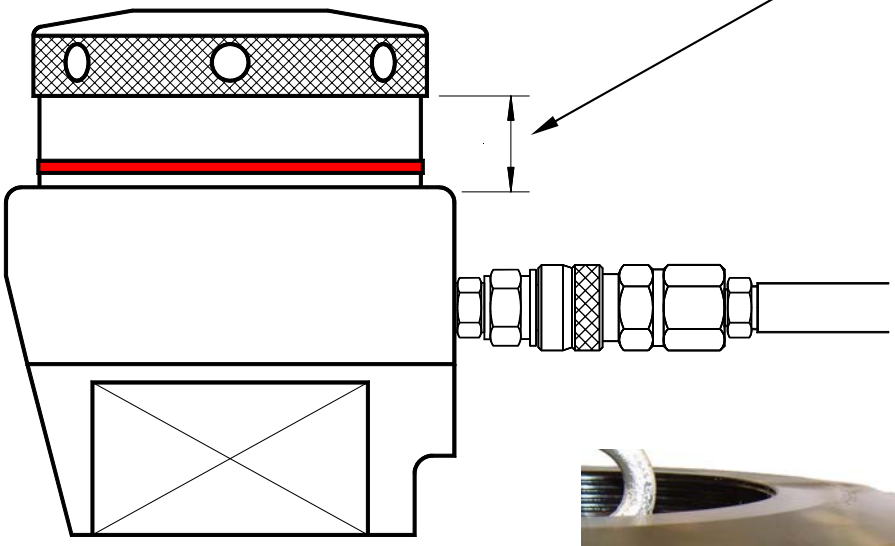


DO NOT exceed the maximum Stroke
Tool No 21 = 12 mm. Other Tools 15 mm

Stroke < 15 mm
(Tool No 21 < 12 mm)



Stroke > 15 mm
(Tool No 21>12mm)



A highly visible red line indicates when the piston has reached its maximum stroke. Stop the pump as soon as the red indicator can be seen.

HEALTH & SAFETY INSTRUCTIONS

Bolt Tensioning Tools

Bolt tensioning tools MUST always be used with a hydraulic pump which has a pressure limiting device. The pump supplied with this equipment has a pressure limit device. Always check that the pump stall pressure is set at or below, the maximum working pressure for the tool being used.

Clear all personnel from the area where the bolt tensioning operation is to be performed. Position the pump a safe distance away from the bolt tensioning tools. Set up barriers and warning signs, or make other adequate arrangements to prevent unauthorised personnel from accidentally straying into the bolt tensioning area.

Make certain that nobody is allowed to stand near to a bolt tensioning tool during the pressurisation process. At no time should anyone allow any part of their body to be positioned over the PULLER of a bolt tensioning tool, whilst the pressure is rising or when it is pressurised. Do not allow anyone to stand anywhere near a direct line with the long axis of a bolt during the tensioning operation. In the case of studbolts with nuts at each end it is important that nobody stands in line with the long axis of the bolt at either end during the tensioning operation.

Do not approach a bolt tensioning tool whilst it is being pressurised. Remember that a damaged bolt or tool is most likely to fail at this critical time. When the operating pressure has been reached, approach a pressurised bolt tensioning tool only for as long as it takes to turn the permanent nut always keeping away from the axis of the bolt and the PULLER.

HEALTH & SAFETY INSTRUCTIONS

Bolt Tensioning Tools

Never leave a pressurised bolt tensioning tool unattended. Keep the bolt tensioning tools under pressure for the minimum time necessary to complete the bolt tightening job.

Wear SAFETY GLASSES and GLOVES when using bolt tensioning tools.

The tools should only be used as a bolt tensioning tool. DO NOT use the tools as hydraulic jacks or for any other purpose.

Take care when handling the tools. Large tools may be heavy and require the use of lifting equipment.

The BRIDGE and CYLINDER of the larger tools are not held together. The CYLINDER and BRIDGE are easily taken apart. When handling the tools always support the BRIDGE and the CYLINDER, otherwise the BRIDGE may become detached from the CYLINDER and fall.

Do not pick up or carry bolt tensioning tools around using the flexible hydraulic hoses as a handle.

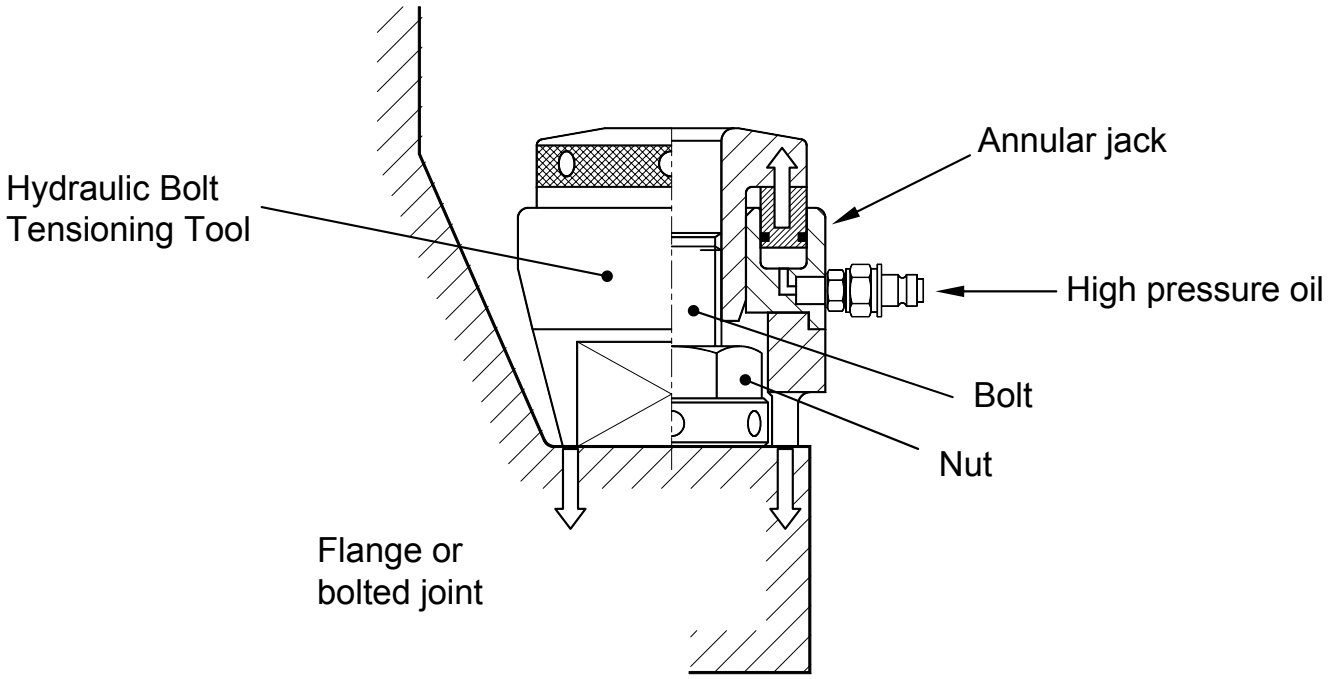
Do not try to tighten a leaking hydraulic connection when it is under pressure. First release the pressure then repair the leak.

SECTION 3

OPERATING INSTRUCTIONS

Introduction

A hydraulic bolt tensioning tool provides a quick and easy method for tightening large diameter bolts to high and accurate pre-loads. Unlike conventional methods it does not use torque and does not require any forceful turning of the nut or bolt, like impact wrenches, flogging spanners or hydraulic torque wrenches. All of these methods have one common enemy, FRICTION. Overcoming thread friction and friction between the nut and the washer uses up over 80% of the torque energy applied to the nut or bolt, leaving less than 20% of the energy to produce useful tension in the shank of the bolt. Variations in this friction loss, from bolt to bolt causes non uniform tension in bolts that have been tightened to the same torque or impact wrench setting.



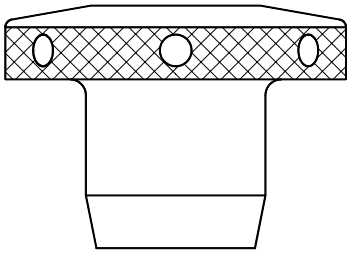
A hydraulic bolt tensioner is an annular jack which fits over the bolt and nut to be tightened. The jack pushes against the bolted joint and pulls on the end of the bolt, which needs to be at least one diameter longer to accommodate the bolt tensioning tool. Because the force produced, by the jack, is applied directly to the end of the bolt, a tension equal to the load generated by the jack is developed in the shank of the bolt. With the jack applying the tension, it is possible to turn the nut with zero torque until it is tight. The load applied by the jack is then relaxed and a high percentage, depending on the length of the bolt and its diameter, is retained in the shank of the bolt.

Bolt tensioning tools can be ganged together to enable multiple bolts to be tightened simultaneously, to the same high and accurate pre-load. This is particularly useful when compressing gaskets in pipeline or pressure vessel flanged connections. The high load developed by the multiple bolt tensioning tools, is evenly distributed around the joint causing the gasket to flow into the surface irregularities of the flange giving a much better seal.

Flexible hoses with self sealing quick connect couplings are used to gang the bolt tensioning tools together to form a hydraulic ring main. The ring main and tensioning tools are pressurised using an air driven pump working from a compressed air supply.

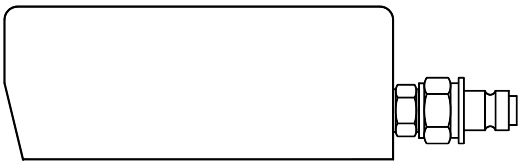
Main component parts

The diagrams below show the component parts of a typical bolt tensioning tool and the order in which they are assembled together onto the bolt and nut to be tightened. The last diagram shows the tool fully assembled.



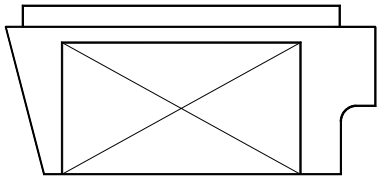
PULLER

The PULLER has an internal thread to suit the bolt. The outside edge is knurled to assist rotation by hand and tommy bar holes are provided for final tightening. The PULLER has a nose to assist location into the centre of the CYLINDER and onto the bolt. The PULLER transfers the force developed by the CYLINDER into tension in the bolt.



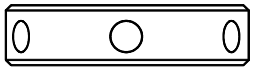
CYLINDER

The CYLINDER is an annular hydraulic jack. The bolt and PULLER pass through the centre of the CYLINDER. A recess is provided in the base of the CYLINDER to accept the BRIDGE. One or two self sealing quick disconnect nipples are provided for connecting the hydraulic hoses.



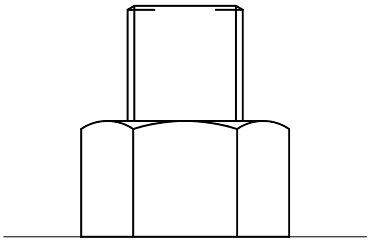
BRIDGE

The BRIDGE supports the CYLINDER over the bolt , nut and SOCKET. A circular groove has been added to fit a socket retaining ring which optionally retains the SOCKET within the BRIDGE. Flats on each side of the BRIDGE give clearance for adjacent nuts. An angled flat at the rear clears the welding neck of a flange or other obstruction. A cut out in the front of the BRIDGE allows access to the SOCKET with a tommy bar, to turn the nut when the bolt is tensioned.



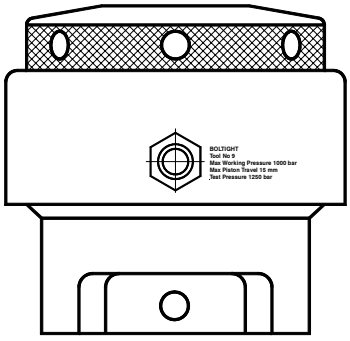
SOCKET

The SOCKET fits over the hexagon nut and inside the BRIDGE. It has tommy bar holes to avoid the need to drill holes in the flats of the hexagon nut.



BOLT & NUT

An extra length of thread must protrude through the nut for the tensioner to screw onto and apply the bolt tension. The length of bolt is very important. Details are given in the instructions to follow. Good quality bolts and nuts will make the tensioning operation quicker and more accurate. Do not use washers under the nut when using a bolt tensioner.



FULLY ASSEMBLED TOOL

This diagram shows a tool with single hydraulic connection, fully assembled onto a bolt and nut ready for the hydraulic hose to be connected and the tensioning operation to commence. Through the BRIDGE the tommy bar holes in the SOCKET are seen. The following pages describe fully each stage of the tool assembly and bolt tightening operation.

Main component parts

Puller

Hydraulic Cylinder

Bridge

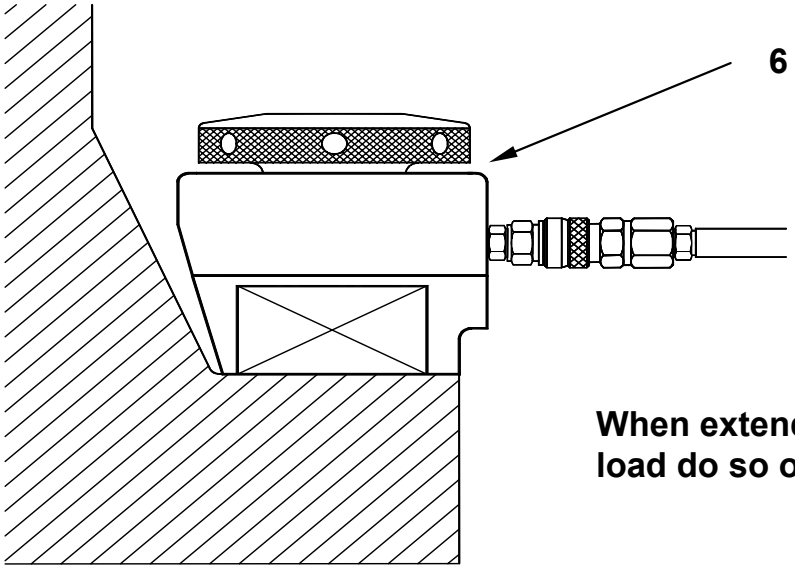
Socket

Operating Instructions

To obtain the best results from your bolt tensioning equipment you should carefully follow the operating instructions given in the following pages. You should also observe the instructions given below.

DO NOT try to pressurise the HYDRAULIC CYLINDER unless it is properly seated on its BRIDGE and the PULLER has been correctly fitted onto the bolt to be tightened or released. If the HYDRAULIC CYLINDER is pressurised when it is not on a BRIDGE or when a PULLER is not properly fitted, the HYDRAULIC CYLINDER may be so badly damaged that it cannot be used again.

DO NOT try to use the pump to push the PISTON out of the HYDRAULIC CYLINDER at zero load, by more than 6 mm before it comes into contact with the a PULLER. If you do want to push out the PISTON by more than 6 mm do so only in 6 mm stages and ensure the PISTON is brought back into alignment with the HYDRAULIC CYLINDER by the use of the PULLER at the end of each 6 mm of travel. Failure to do so may cause the PISTON to score the CYLINDER BODY. The HYDRAULIC CYLINDER may be so badly damaged that it cannot be used again.



When extending the piston under zero load do so only in 6mm stages

OPERATING INSTRUCTIONS

HOW TO TIGHTEN A BOLT

STEP 1 TIGHTENING A BOLT

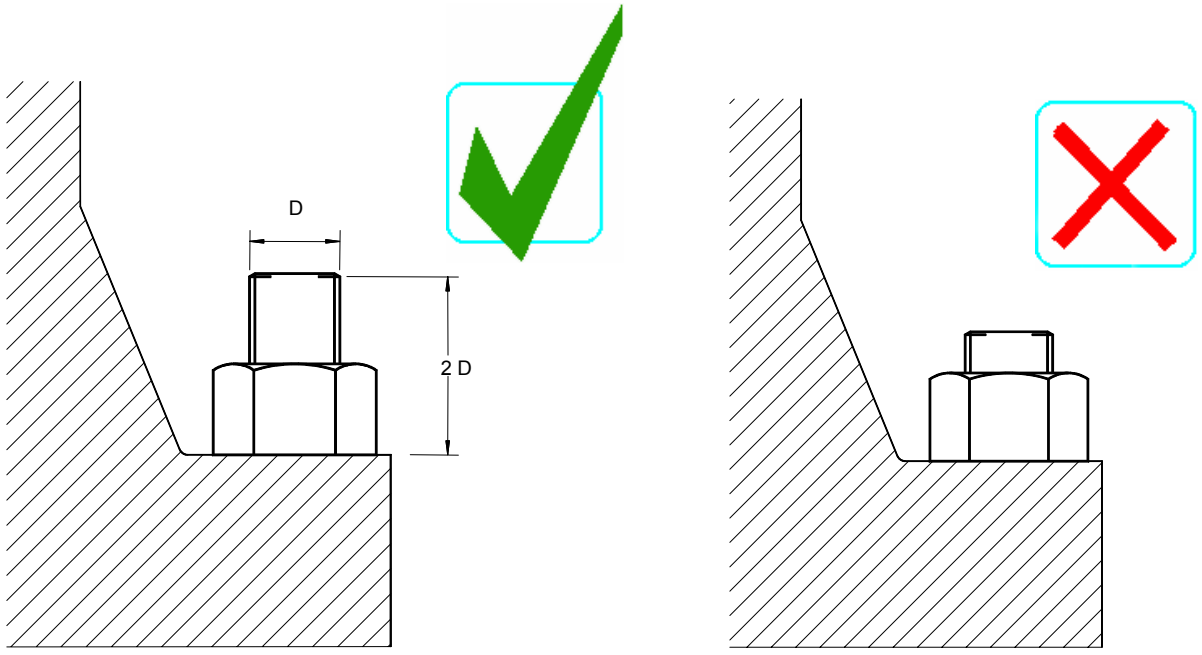
Assemble the joint with the bolts and nuts to be tightened. Do not use WASHERS under the nuts.

Make sure thread length equal to a minimum of two bolt diameters is protruding from the surface of the flange or joint on the side the bolt tensioning operation is to be performed. The bolt tensioner is designed to cope with thread lengths in excess of two diameters.

It is very important this operation is performed properly otherwise the thread engagement between the bolt tensioner and the bolt will be less than one diameter, which could cause the bolt and/or bolt tensioner threads to be stripped.

HEALTH & SAFETY WARNING

If only a few threads protrude and an attempt is made to apply tension the bolt threads will strip and components of the tensioner could be launched with the possibility of serious injury.



CORRECT and SAFE **WRONG and DANGEROUS**

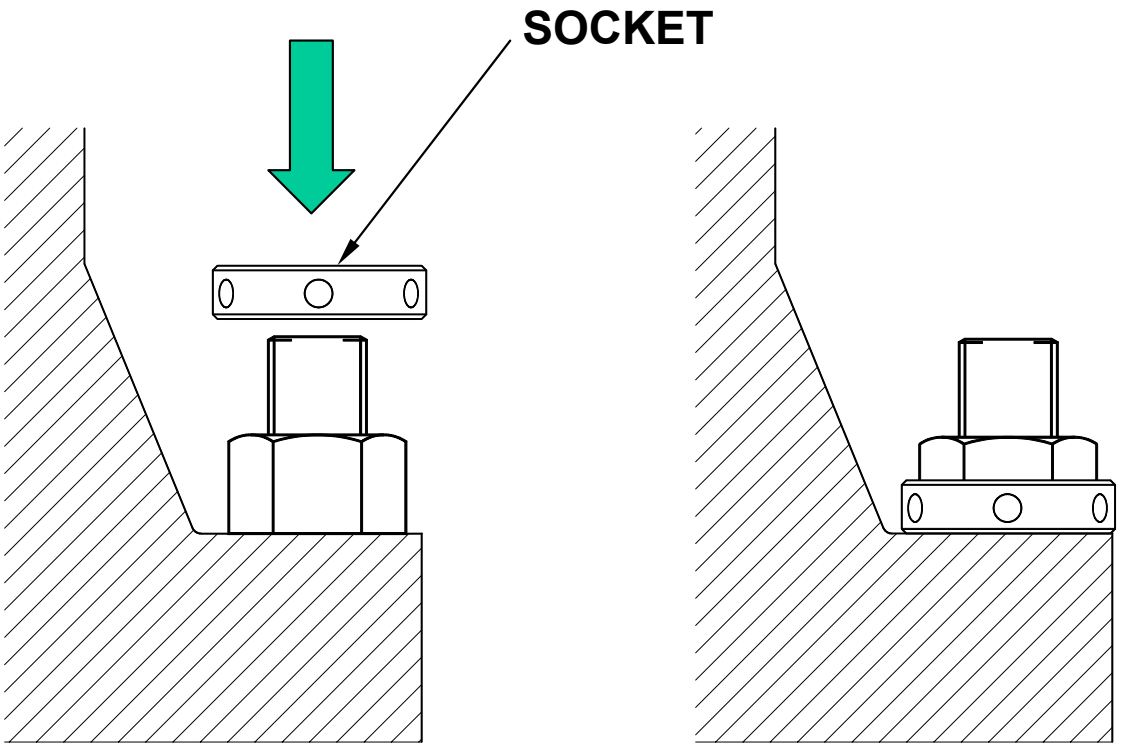
STEP 2 TIGHTENING A BOLT

Place the SOCKET over the nut to be tightened.

When tensioning bolts with hexagon nuts it is normal to use the SOCKET, which is drilled with tommy bar holes, as the method for turning the nut when the bolt tension is applied.

On some tools there is a circular groove in the BRIDGE to fit a socket retaining ring, which gives the option of captivating the SOCKET within the BRIDGE. If this option is chosen there is no need to place the SOCKET over the nut separately to the BRIDGE and this step can be ignored.

Also, in some circumstances and applications the hexagon nuts are pre drilled with tommy bar holes in the flats of the nut. Sometimes circular or ring nuts are used instead of hexagon nuts and these will also be pre drilled with tommy bar holes. In these circumstances the SOCKET is not required at all and this step can be ignored.

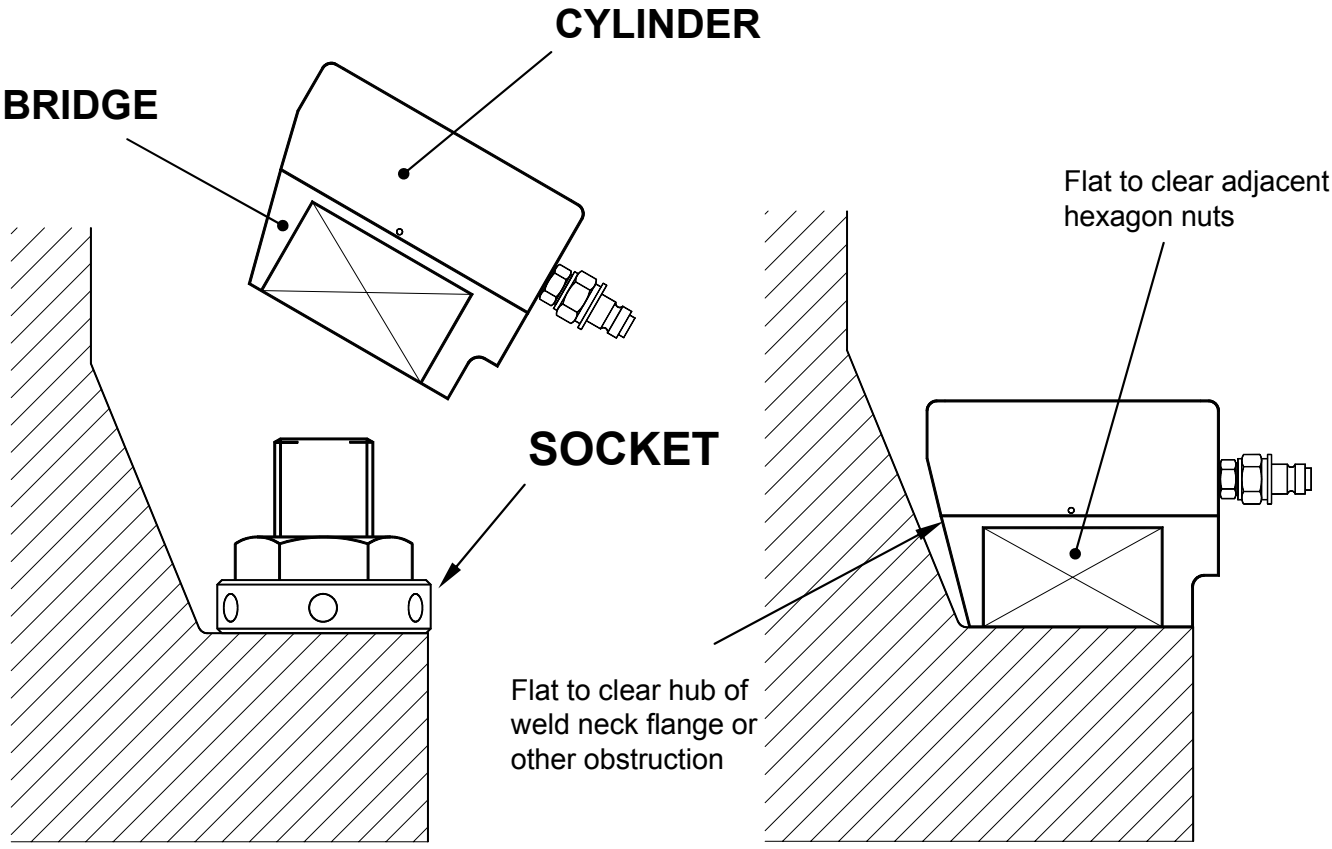


STEP 3 TIGHTENING A BOLT

Place the CYLINDER and BRIDGE assembly over the nut, bolt and SOCKET.

The CYLINDER and BRIDGE are assembled together using spring loaded ball screws around the outside of the base of the CYLINDER. The BRIDGE and CYLINDER can be rotated relative to each other. This allows the self sealing quick connect hydraulic connection on the CYLINDER to be positioned in the best position for connecting the flexible hydraulic hose. In applications where space is limited above the bolt, it may be helpful to separate the BRIDGE and the CYLINDER, placing them individually onto the bolt. Pull the BRIDGE away from the CYLINDER to remove it. Push the two back together again afterwards.

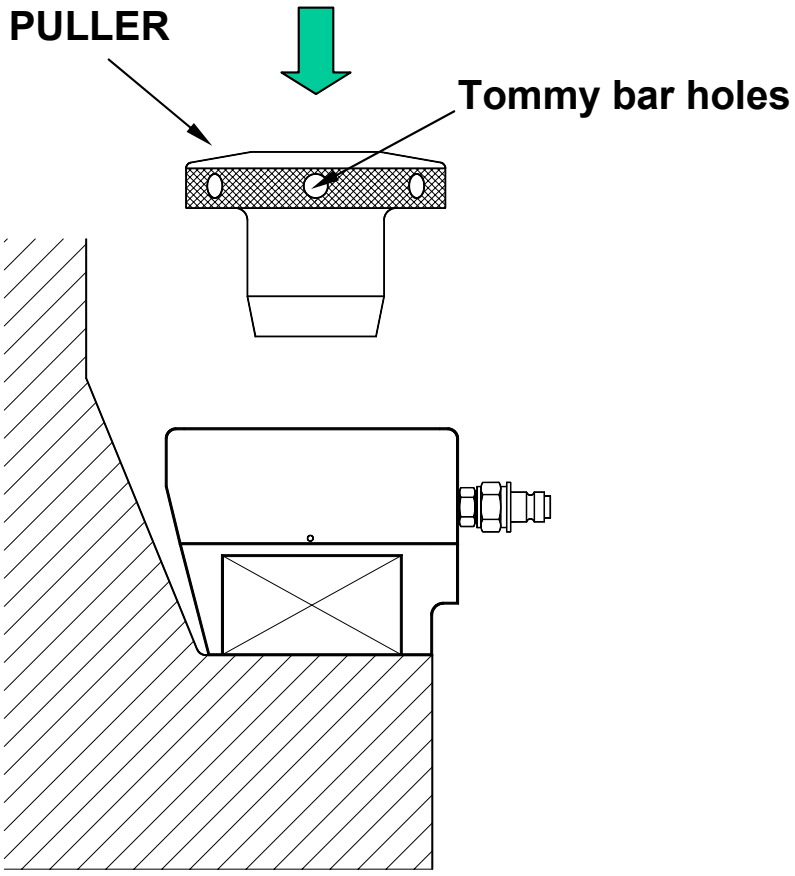
The BRIDGE has a recess to accept the SOCKET, nut and bolt. A window in the front of the BRIDGE allows access to the SOCKET with a tommy bar. The BRIDGE may have flats on each side to clear the adjacent nuts. The BRIDGE and CYLINDER may have an angled flat at the back to clear any obstruction behind the bolt and nut, such as the hub of a weld neck flange.



STEP 4 TIGHTENING A BOLT

Place the PULLER into the centre of the CYLINDER and BRIDGE and engage the PULLER thread with the end of the bolt. The PULLER has a nose to assist this operation.

Take care the PULLER and bolt threads are properly engaged and do not become crossed. Do not force the PULLER onto the bolt. The PULLER should turn freely on the bolt.

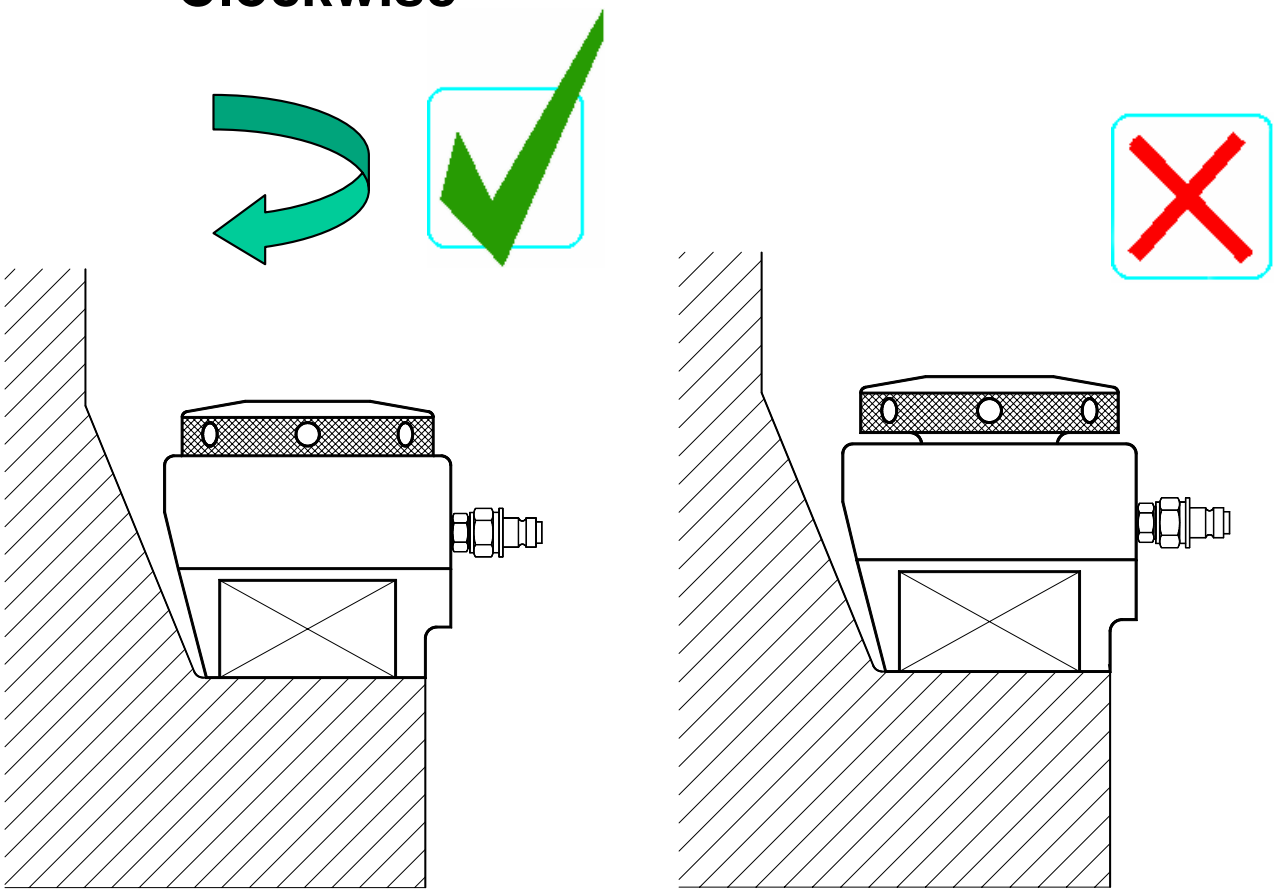


STEP 5 TIGHTENING A BOLT

Screw the PULLER fully down onto the top surface of the CYLINDER. The PULLER will normally be turned by hand but the final nip onto the CYLINDER may require the help of a tommy bar.

Take extra care to stop the bolt turning with the PULLER which would reduce the thread engagement on the bolt. In the worst case the PULLER could be left with only one or two threads engaged even though two diameters of thread were initially protruding through the bolted joint.

Clockwise

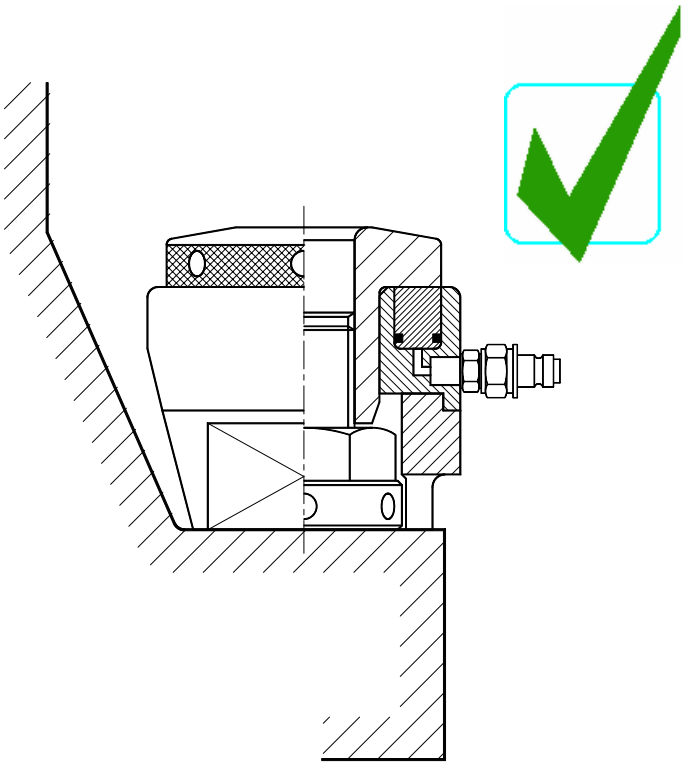


The PULLER is not fully in contact with the top of the CYLINDER

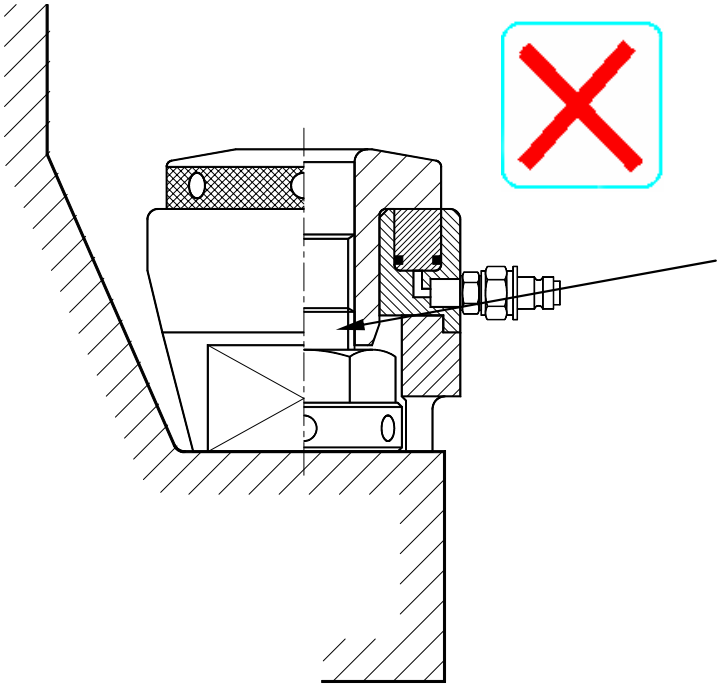
STEP 6 TIGHTENING A BOLT

Once the PULLER has been screwed down, double check the thread engagement with the bolt is still correct.

The bolt tensioner is now locked in place and cannot fall off. The tool is now ready for the hydraulic hose to be connected.



CORRECT



WRONG and DANGEROUS

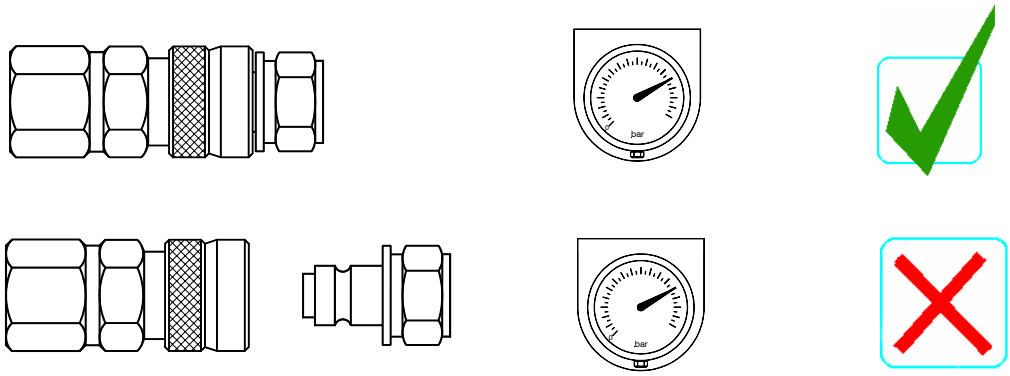
The BOLT has turned with the PULLER and the thread engagement between the BOLT and the PULLER has been reduced.

If pressure is applied the PULLER threads might strip and cause injury.

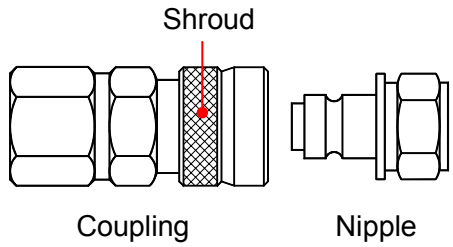
Using the Quick Connect Couplings

DO NOT pressurise the connectors when they are disconnected

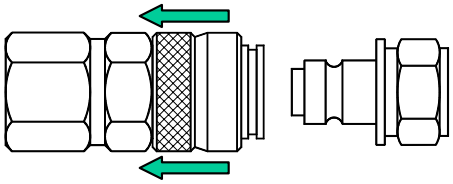
Check there is no pressure in the system before attempting to connect or disconnect the couplings.



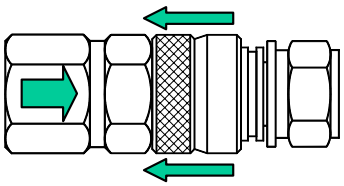
To connect the Quick Connect Coupling and Nipple, first check there is no pressure in the system. Then pull back the shroud by hand and push the coupling onto the nipple. When together, release the shroud which will spring back to lock the Coupling and Nipple together. To disconnect, first check there is no pressure in the system. Pull back the shroud, by hand, and pull the coupling and nipple apart. Release the shroud when apart.



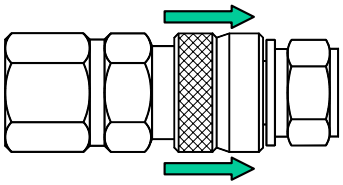
Pull the shroud back to retract



Coupling and Nipple with the shroud retracted

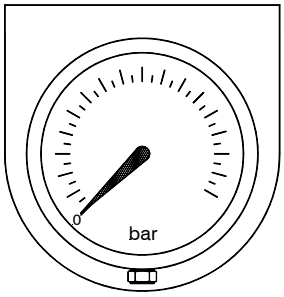


Coupling and nipple pushed together with the shroud still retracted



Shroud released - Coupling and Nipple are now locked together and safe to use.

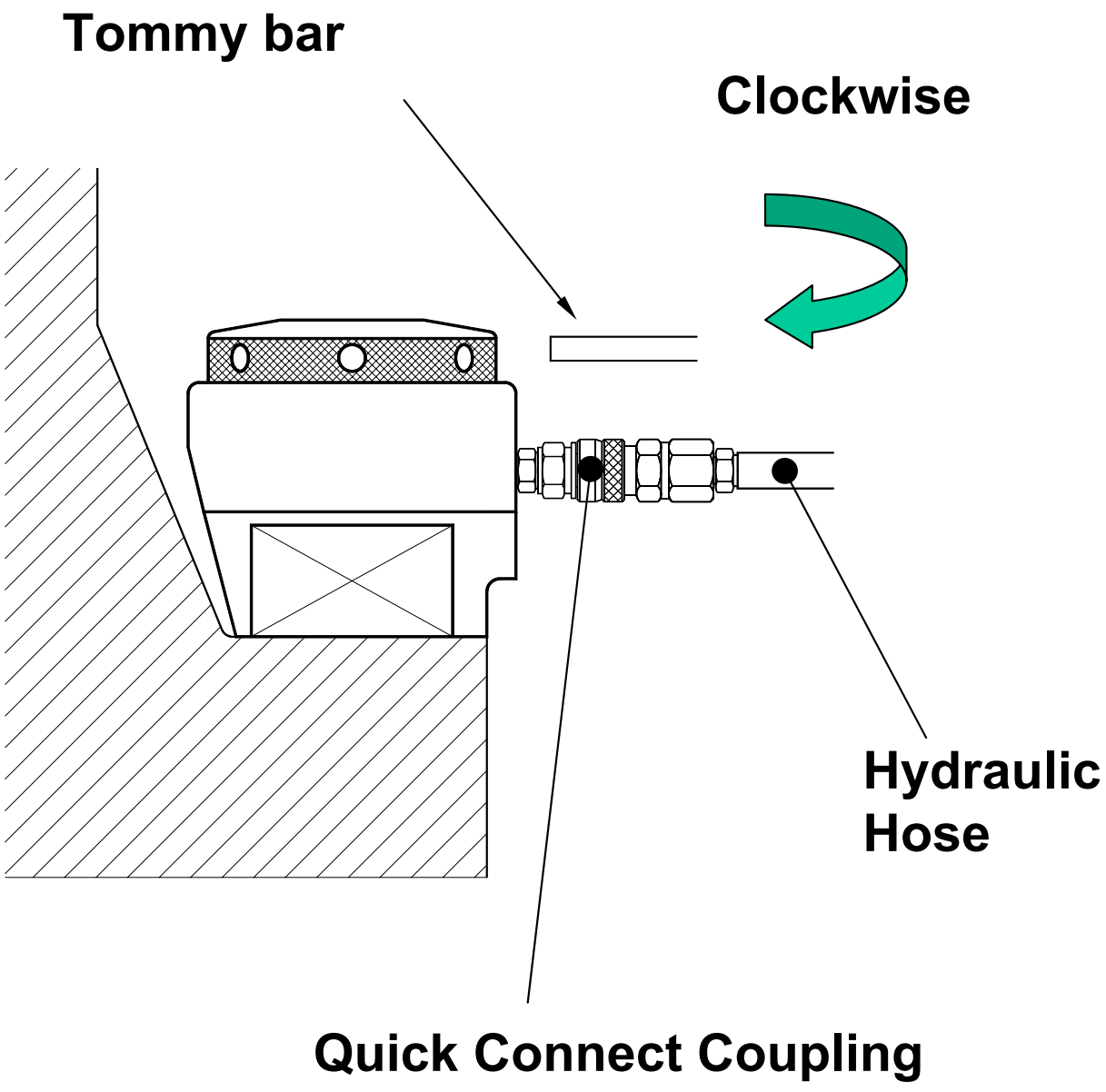
STEP 7 TIGHTENING A BOLT



Connect the hydraulic hose.

Make sure the quick connect coupling is fully engaged.

Tighten the PULLER with the tommy bar.



THINK SAFETY

MOST IMPORTANT - HEALTH & SAFETY

The bolt tensioning tool is now ready to be pressurised. Before proceeding read the Health & Safety Instructions given in this manual then proceed as follows:-

Clear all personnel from the area where the bolt tensioning operation is to be performed. Position the pump a safe distance away from the bolt tensioning tools. Set up barriers and warning signs, or make other adequate arrangements to prevent unauthorised personnel from accidentally straying into the bolt tensioning area.

Make certain that nobody is allowed to stand near to a bolt tensioning tool during the pressurisation process. At no time should anyone allow any part of their body to be positioned over the PULLER of a bolt tensioning tool, whilst the pressure is rising or when it is pressurised. Do not allow anyone to stand anywhere near a direct line with the long axis of a bolt during the tensioning operation. In the case of studbolts with nuts at each end it is important that nobody stands in line with the long axis of the bolt at either end during the tensioning operation.

Do not approach a bolt tensioning tool whilst it is being pressurised. Remember that bolt or tool failure is most likely to happen at this critical time. When the operating pressure has been reached, approach a pressurised bolt tensioning tool only for as long as it takes to turn the permanent nut always keeping away from the axis of the bolt and the PULLER.

Wear eye protection, gloves overalls and a hard hat.

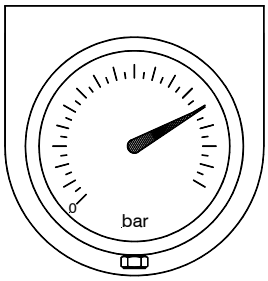
Never leave a pressurised bolt tensioning tool unattended.

Release the oil pressure immediately if any unauthorised person moves into the bolt tensioning area and especially if anyone stands in front of the PULLER of a bolt tensioning tool under pressure or stands in line with the long axis of a bolt being tensioned.

Determine the correct working pressure for the bolts to be tightened.

Proceed with the following operations keeping the bolt tensioning tools under pressure for the minimum time necessary to complete the bolt tightening job.

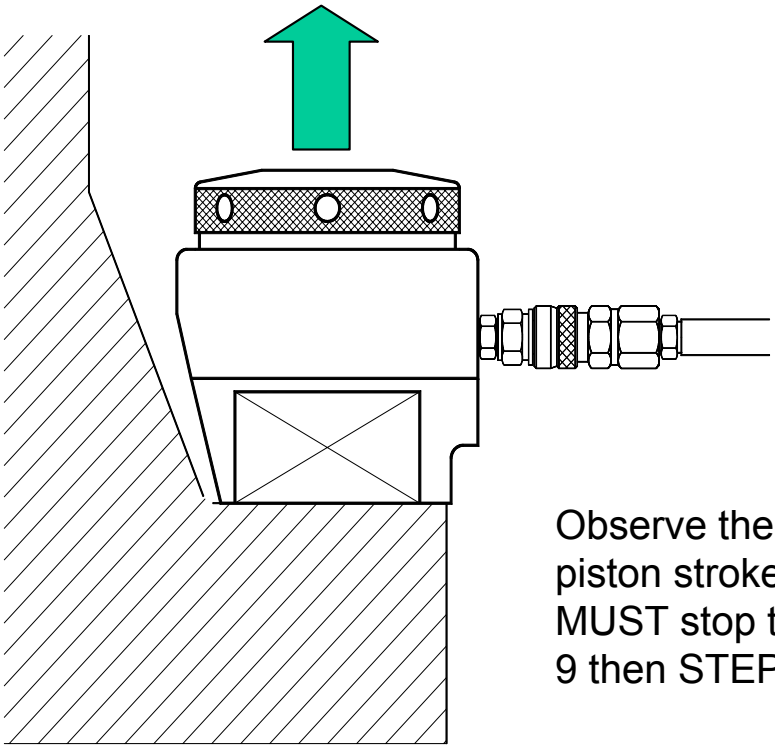
STEP 8 TIGHTENING A BOLT



Apply the correct hydraulic pressure, observing the Health and Safety Instructions. The Piston will move out of the Cylinder as the bolt is stretched and the bolted joint is compressed.

DO NOT exceed the maximum stroke. This is indicated by a red line around the piston.

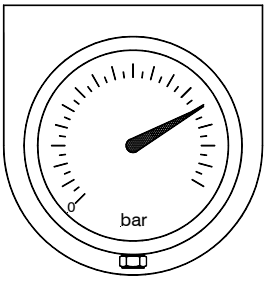
DO NOT exceed the 1500 bar maximum pressure for the tool.



Observe the piston. If the maximum piston stroke indicator is seen you MUST stop the pump and go to STEP 9 then STEP 12 then back to STEP 8.

A highly visible red line indicates when the piston has reached its maximum stroke. Stop the pump as soon as the red indicator can be seen.

STEP 9 TIGHTENING A BOLT

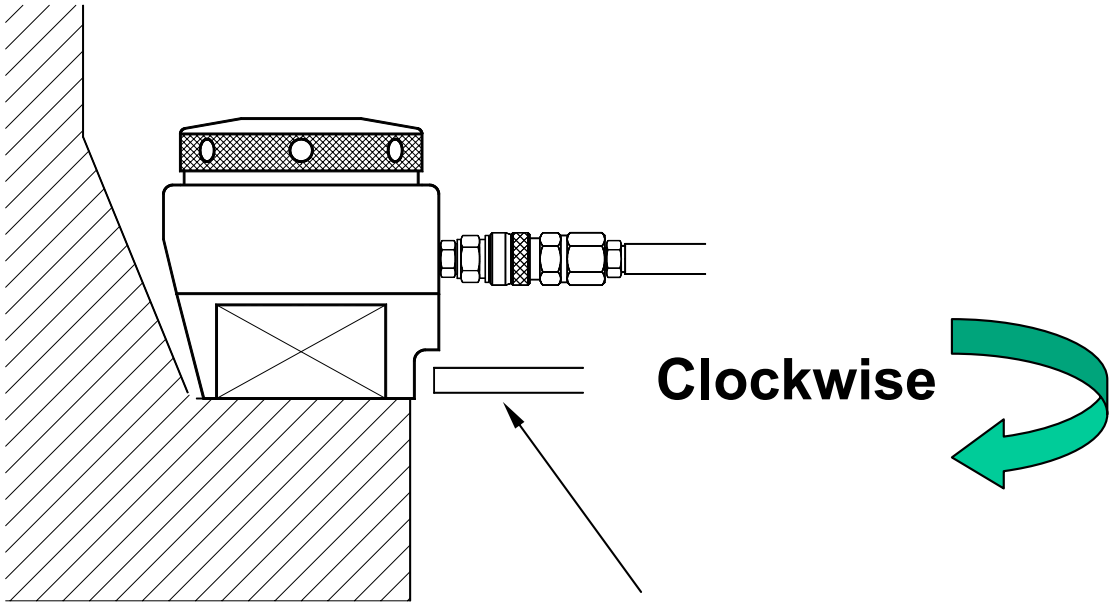


Use a tommy bar to turn the SOCKET clockwise, to tighten the nut.

Insert the tommy bar through the window in the BRIDGE until it engages with a hole in the SOCKET.

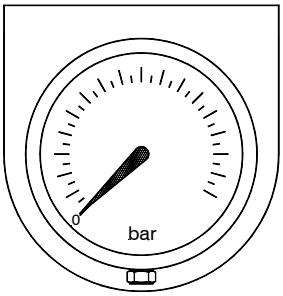
Turn the SOCKET clockwise as far as it will go. If the tommy bar comes into contact with the BRIDGE, remove it and engage the next hole in the SOCKET.

Continue turning the SOCKET until the nut is tight,

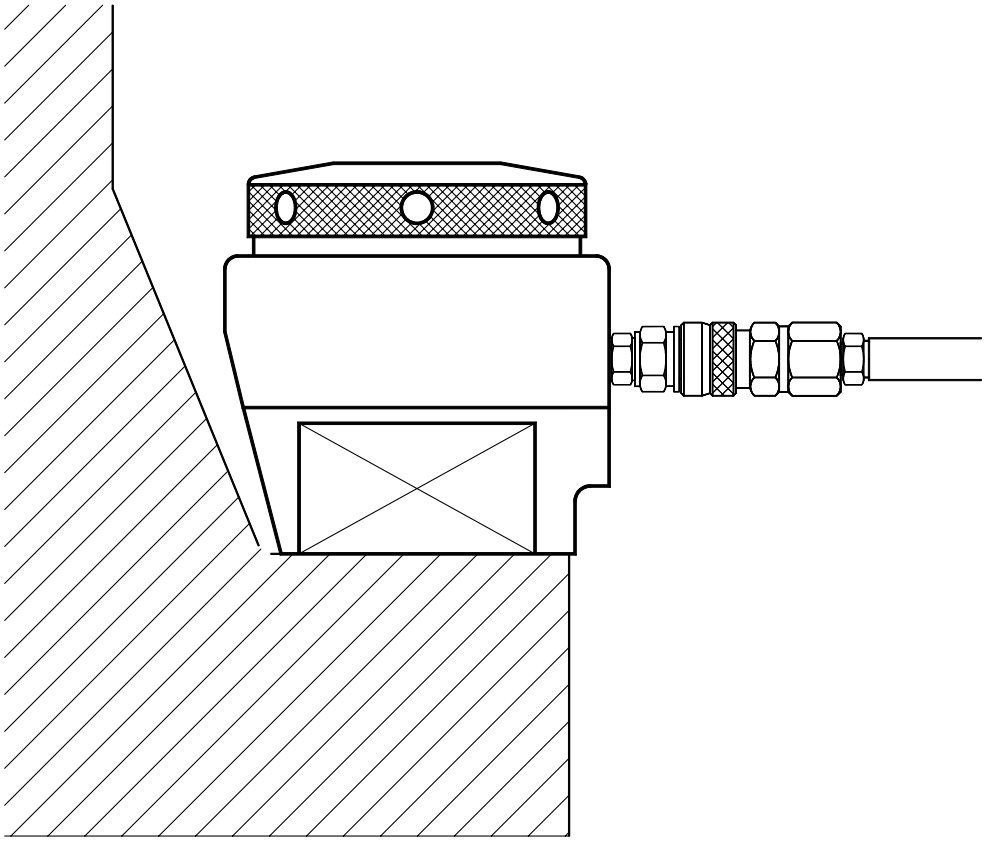


TOMMY BAR

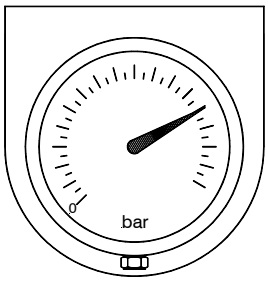
STEP 10 TIGHTENING A BOLT



Release the pressure slowly.



STEP 11 TIGHTENING A BOLT

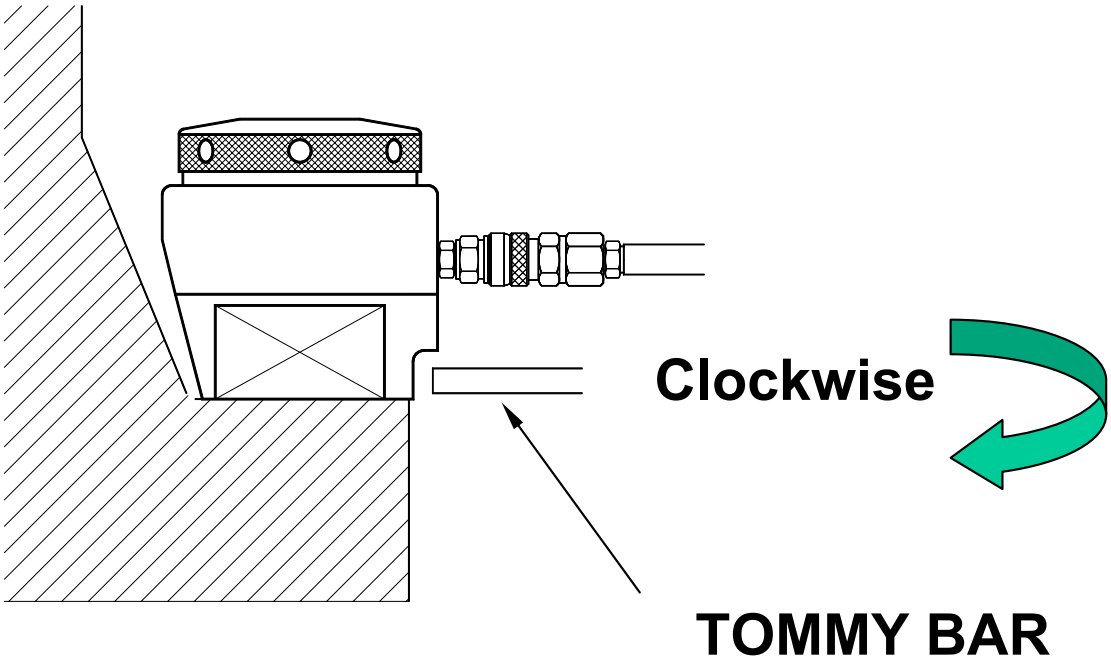


Apply the correct hydraulic pressure again. Observe the Health and safety Instructions

DO NOT exceed the maximum stroke. This is indicated by a red line around the piston.

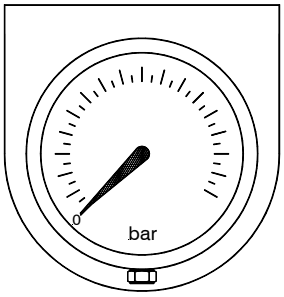
DO NOT exceed the 1500 bar maximum pressure for the tool.

Use the tommy bar to turn the Socket until it is tight again.



A highly visible red line indicates when the piston has reached its maximum stroke. Stop the pump as soon as the red indicator can be seen.

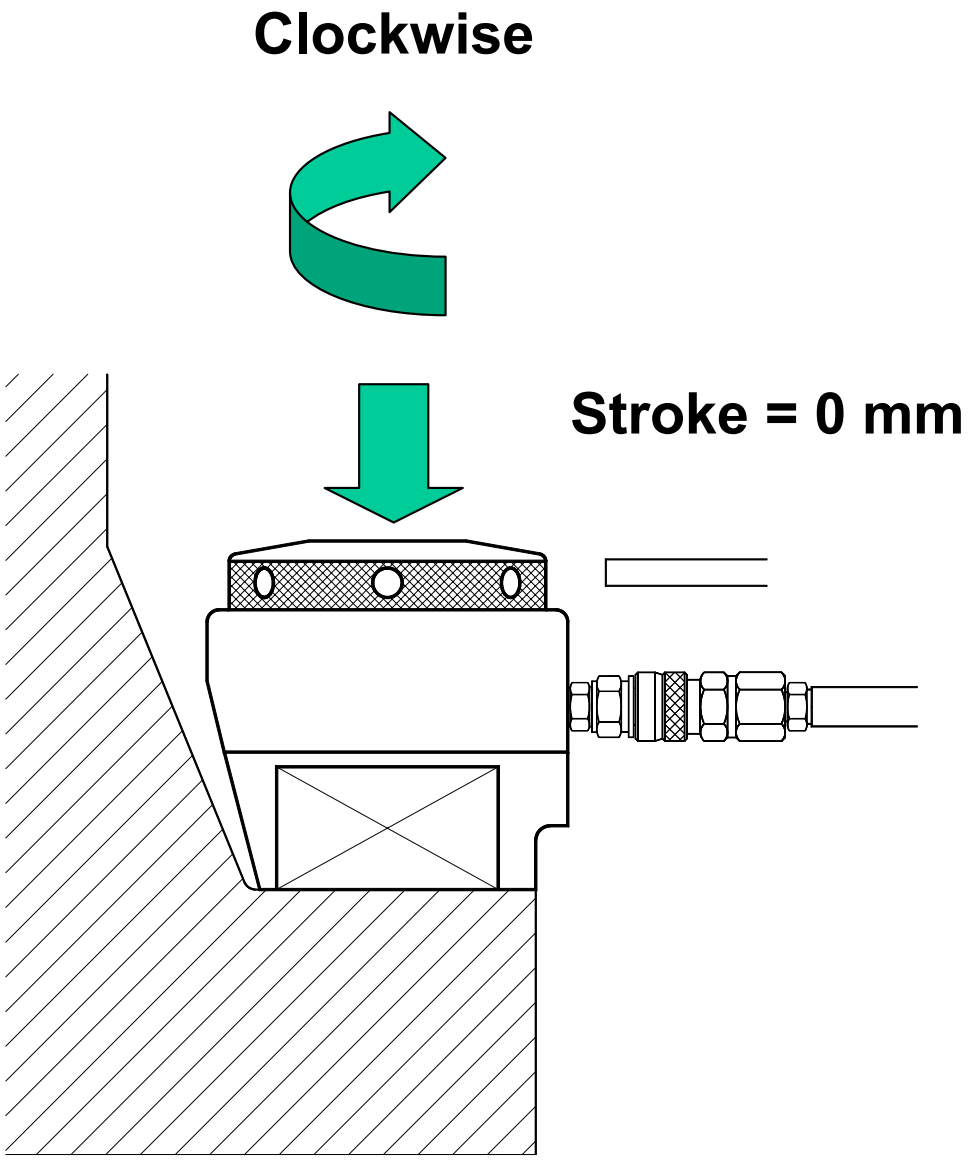
STEP 12 TIGHTENING A BOLT



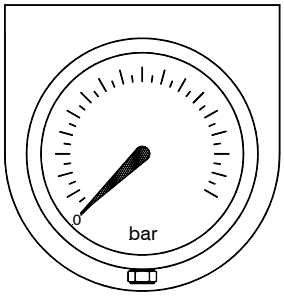
Release the pressure slowly.

Fully open the oil pressure release valve on the pump.

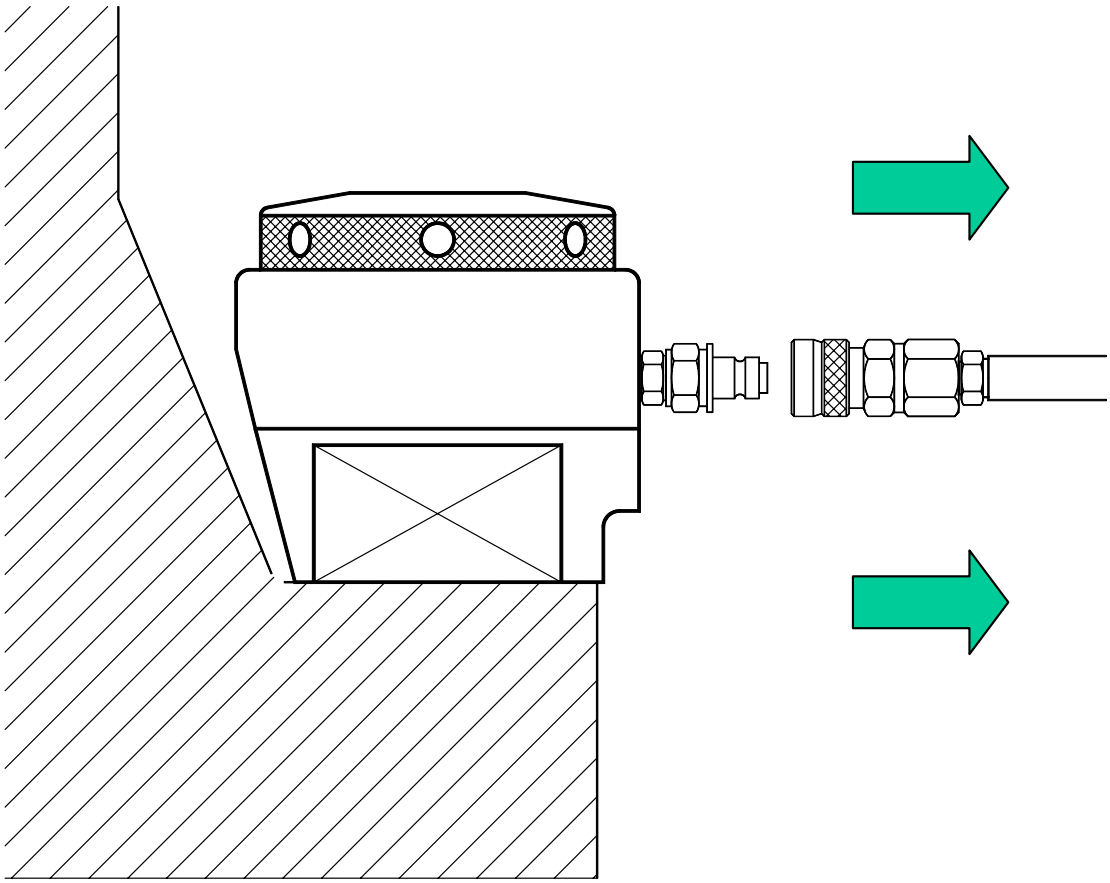
Use the tommy bar to tighten the PULLER until the Piston is fully returned into the CYLINDER. See Section 3 Page 42 for more information on returning the pistons.



STEP 13 TIGHTENING A BOLT



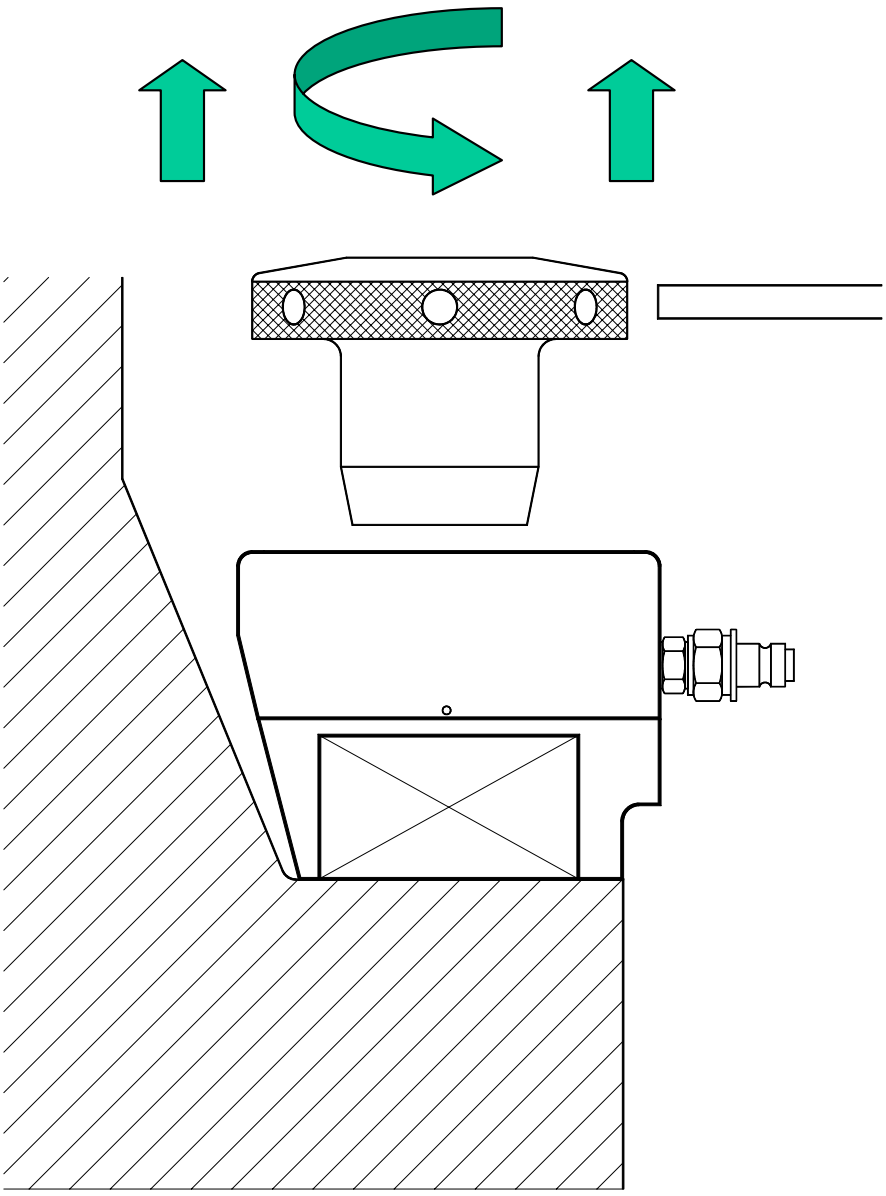
Remove the Hydraulic Hose



STEP 14 TIGHTENING A BOLT

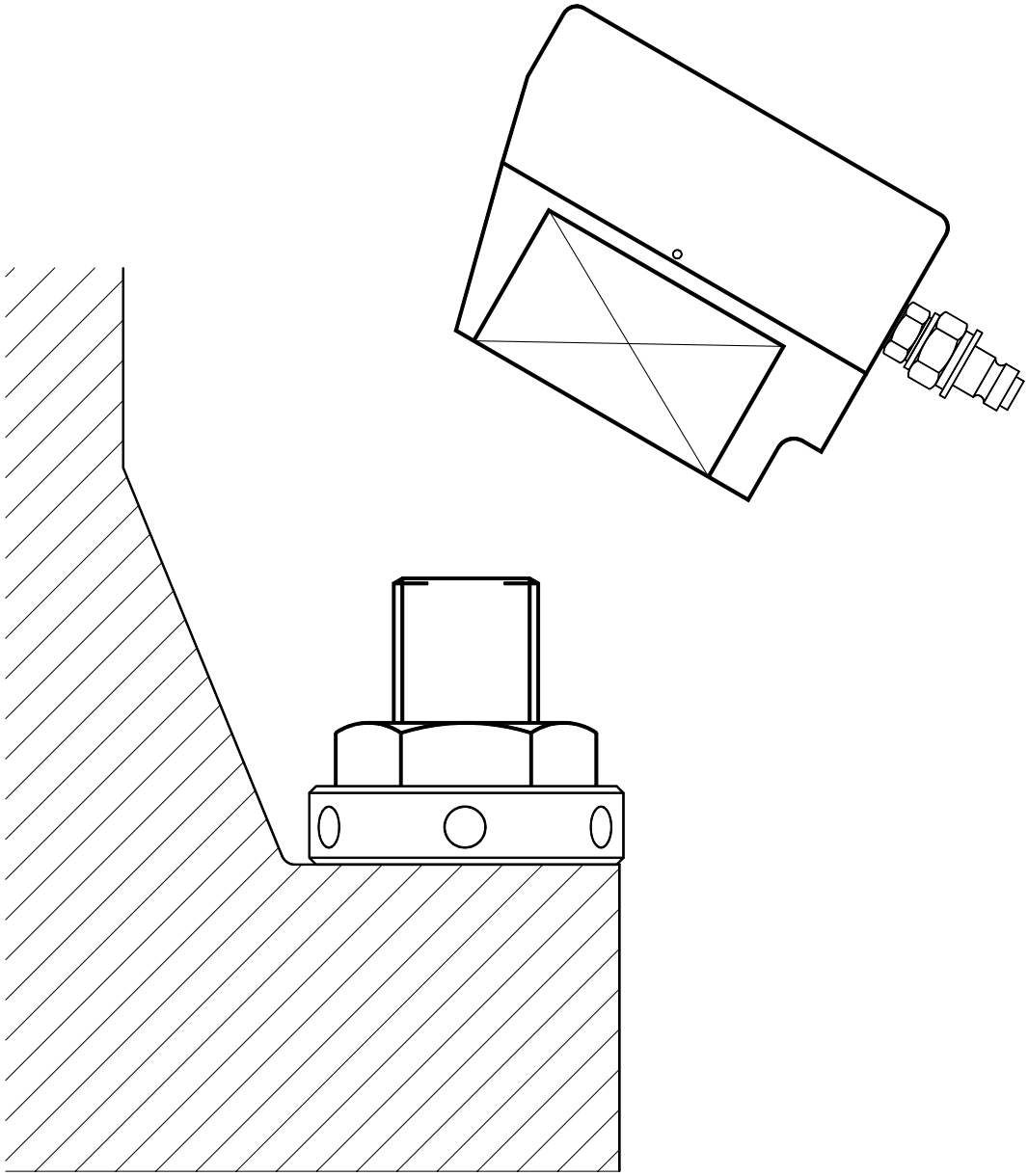
Use the Tommy Bar to release and remove the PULLER.

Anti-Clockwise



STEP 15 TIGHTENING A BOLT

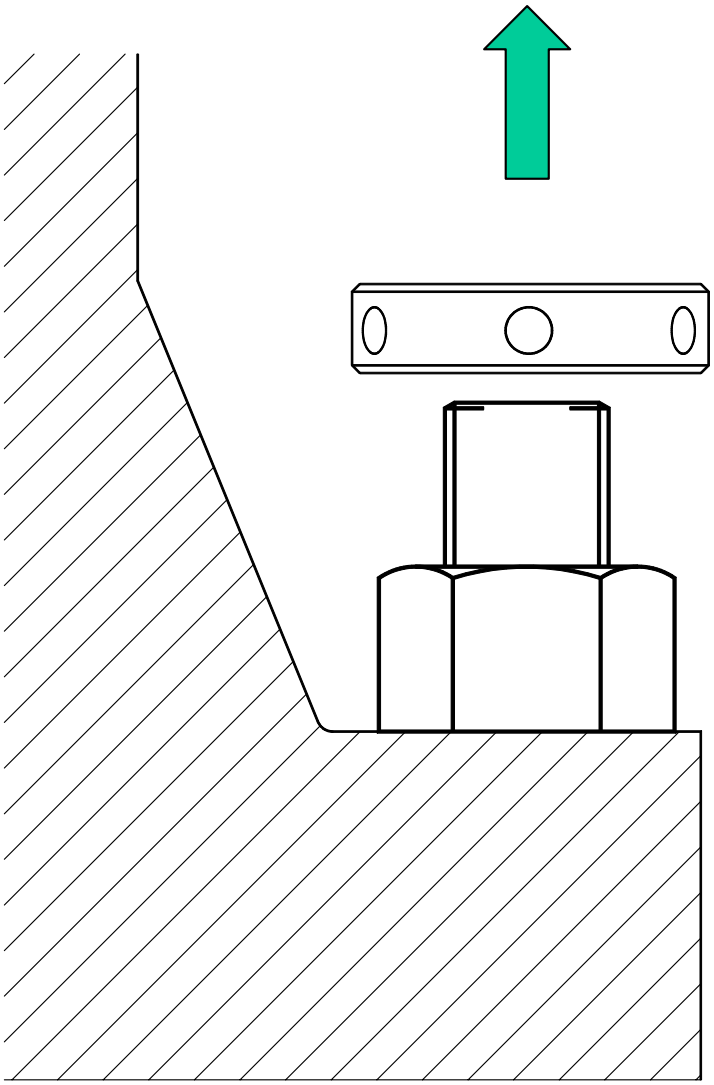
Remove the CYLINDER and BRIDGE



STEP 16 TIGHTENING A BOLT

Remove the SOCKET

The bolt is tight.



OPERATING INSTRUCTIONS

HOW TO LOOSEN A BOLT

STEP 1 LOOSENING A BOLT

Loosening bolts with a bolt tensioning tool is almost the reverse of the tightening operation but there are a couple of very important additions to the procedure. Failure to observe them will leave the nut loose, but the tensioning tool locked onto the bolt which remains tight.

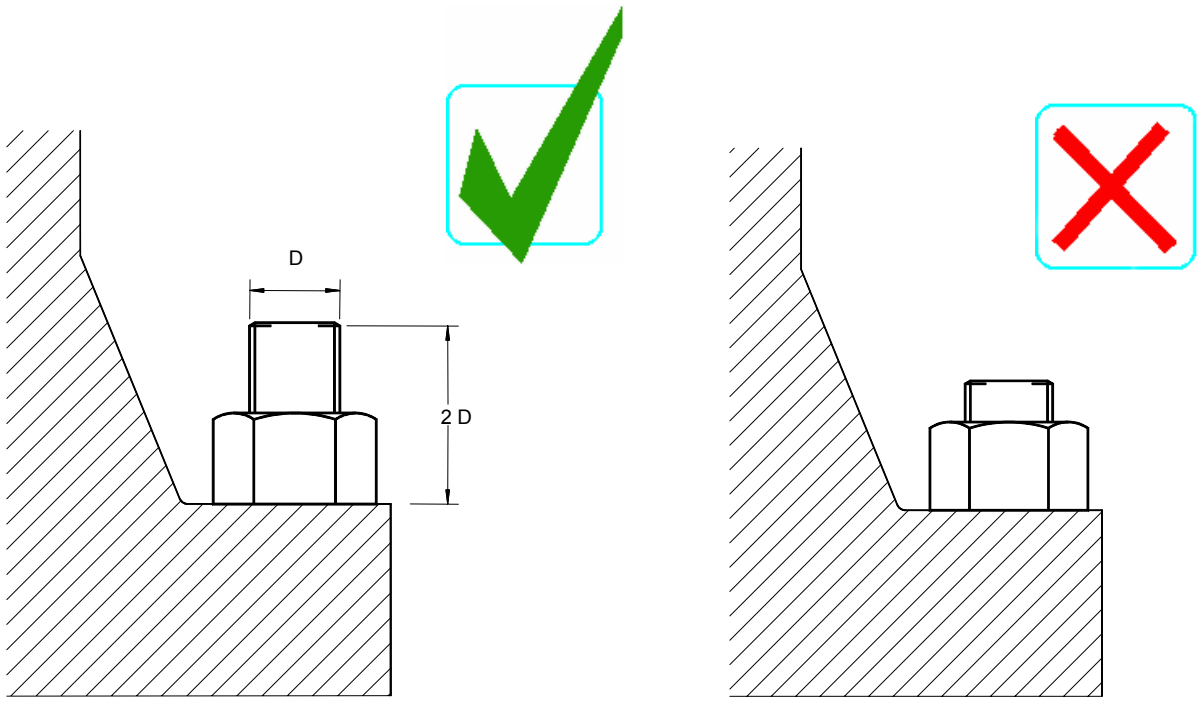
Check the bolts to be loosened. Make sure there is sufficient thread length protruding through the nut and the thread is not damaged. Any bruising of the thread should be rectified with a thread file or die nut before attempting to assemble the hydraulic bolt tensioning tool onto the bolt.

Make sure a thread length equal to a minimum of two bolt diameters is protruding from the surface of the flange or joint on the side the operation is to be performed. The bolt tensioner is designed to cope with thread lengths in excess of two diameters.

If the bolts have been tightened with a bolt tensioner it is most likely that sufficient thread length will be available however, it is very important this check is performed otherwise the thread engagement between the bolt tensioner and the bolt might be less than one diameter, which could cause the bolt and/or bolt tensioner threads to be stripped.

HEALTH & SAFETY WARNING

If only a few threads protrude and an attempt is made to apply tension the bolt threads will strip and components of the tensioner could be launched with the possibility of serious injury.



CORRECT and SAFE **WRONG and DANGEROUS**

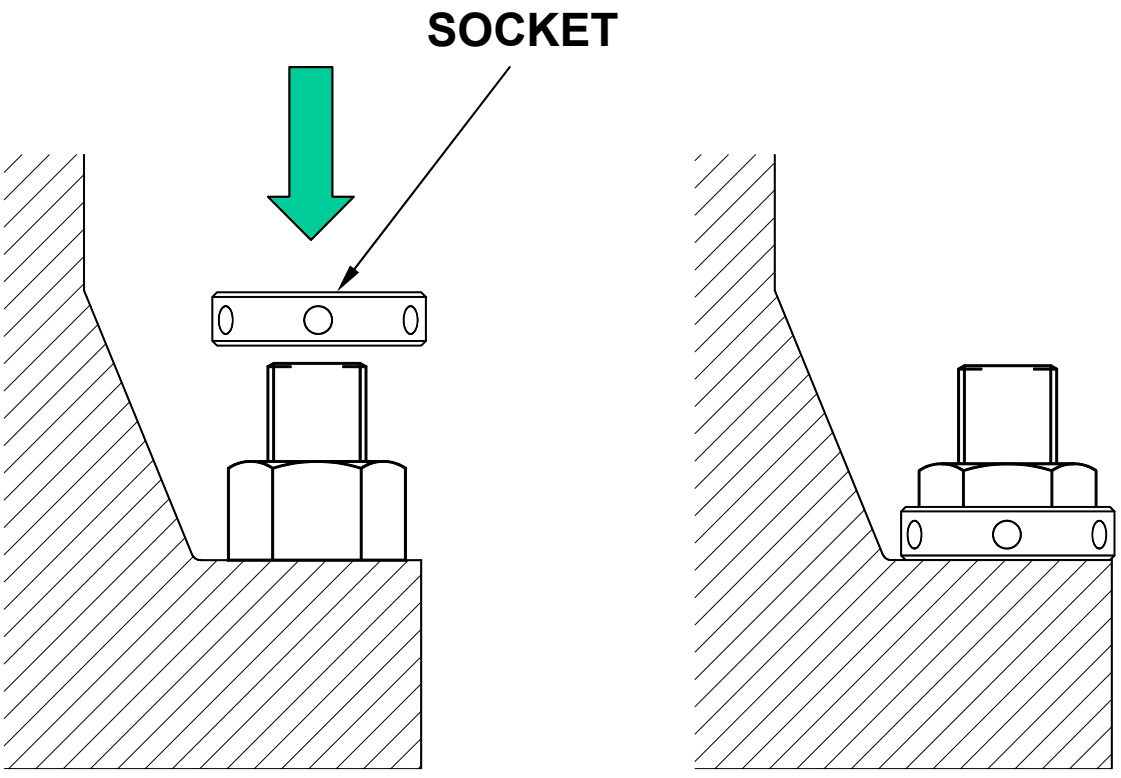
STEP 2 LOOSENING A BOLT

Place the SOCKET over the nut to be loosened.

When loosening bolts with hexagon nuts it is normal to use the SOCKET, which is drilled with tommy bar holes, as the method for turning the nut when the load from the tool is applied.

On some tools there is a circular groove in the BRIDGE to fit a socket retaining ring, which gives the option of captivating the SOCKET within the BRIDGE. If this option is chosen there is no need to place the SOCKET over the nut separately to the BRIDGE and this step can be ignored.

In some circumstances and applications the hexagon nuts are pre drilled with tommy bar holes in the flats of the nut. Sometimes circular or ring nuts are used instead of hexagon nuts and these will also be pre drilled with tommy bar holes. In these circumstances the SOCKET is not required and this operation can be ignored.

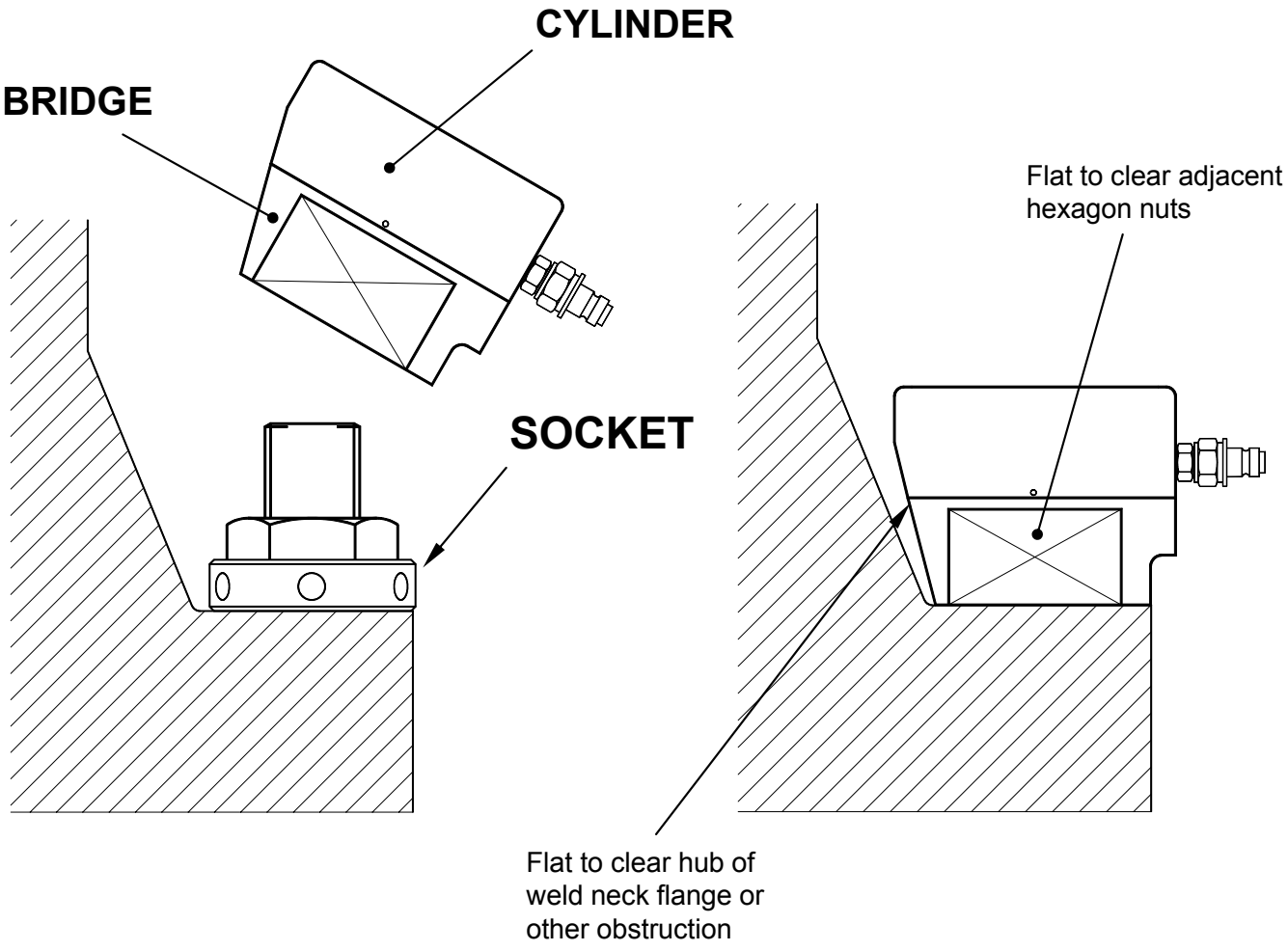


STEP 3 LOOSENING A BOLT

Place the CYLINDER and BRIDGE assembly over the nut, bolt and SOCKET.

The CYLINDER and BRIDGE are assembled together using small spring loaded screws around the outside of the base of the CYLINDER. The BRIDGE and CYLINDER can be rotated relative to each other. This allows the self sealing quick disconnect hydraulic connection on the CYLINDER to be positioned in the best position for connecting the hydraulic hose. In applications where space is limited above the bolt, it may be helpful to separate the BRIDGE and the CYLINDER, placing them individually onto the bolt.

The BRIDGE has a recess to accept the SOCKET, nut and bolt. A window in the front of the BRIDGE allows access to the SOCKET with a tommy bar. The BRIDGE may have flats on each side to clear the adjacent nuts. The BRIDGE and CYLINDER may have an angled flat at the back to clear any obstruction behind the bolt and nut, such as the hub of a weld neck flange.

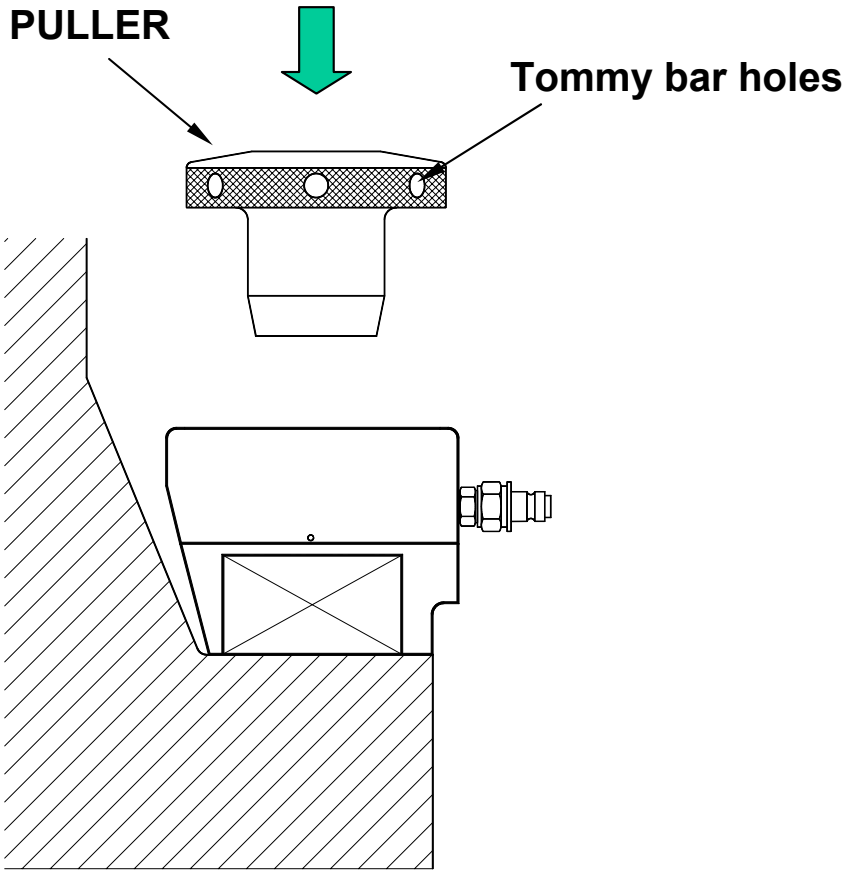


STEP 4 LOOSENING A BOLT

Place the PULLER into the centre of the CYLINDER and BRIDGE assembly and engage the PULLER thread with the end of the bolt. The PULLER has a nose to assist this operation.

Take care the PULLER and bolt threads are properly engaged and do not become crossed. Do not force the PULLER onto the bolt. The PULLER should turn freely on the bolt. Screw the PULLER fully down onto the top surface of the CYLINDER.

The PULLER will normally be turned by hand but the final nip onto the CYLINDER may require the help of a tommy bar. Once the PULLER has been screwed down the tool is locked in place and cannot fall off.

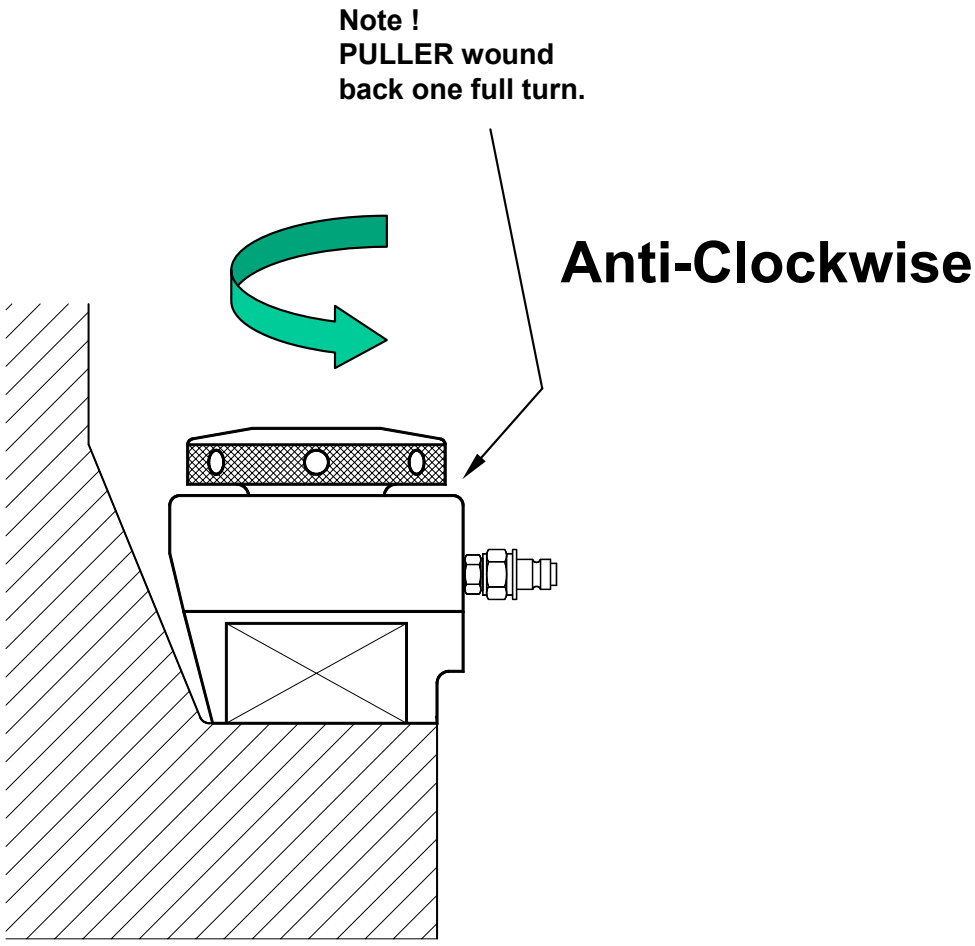


STEP 5 LOOSENING A BOLT

Now turn back the PULLER at least one full revolution. The bolt tensioning tool will still be captive on the end of the bolt but it will be free to slide along the PULLER. This operation ensures the PISTON can retract into the CYLINDER when the bolt becomes free and needs to return to its original length.

If you do not do this the load in the bolt will simply be transferred from the nut to the PULLER during the untightening operation. It will be impossible to remove the bolt tensioning tool from the bolt. If this happens, re-tighten the bolt using the bolt tensioner, tighten the nut using the tommy bar and release the oil pressure. The PULLER can then be wound back the one full turn necessary to avoid this situation arising again.

The tool is now ready for the hydraulic hose to be connected.



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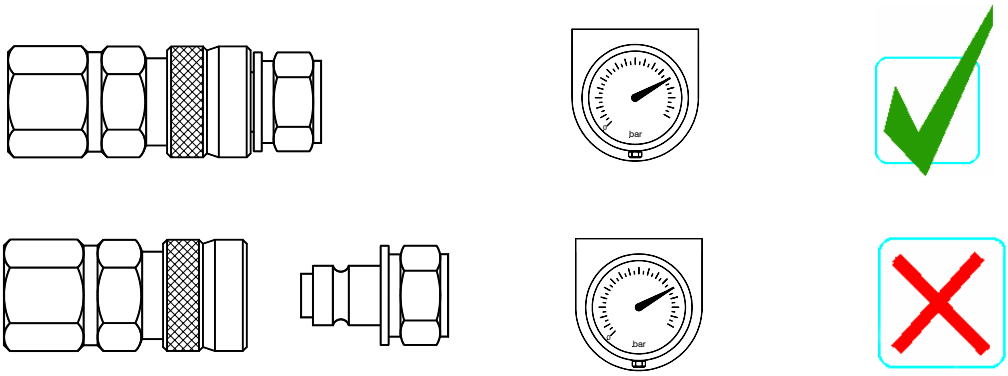

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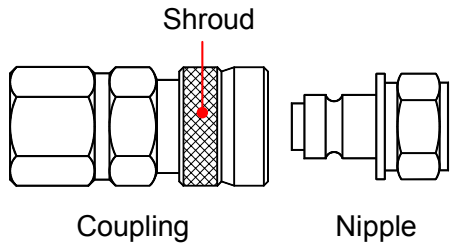
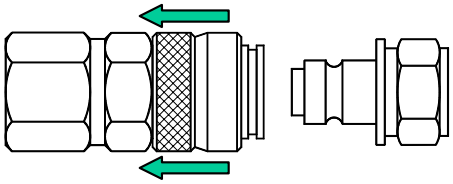
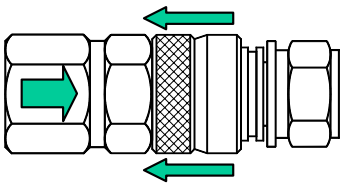


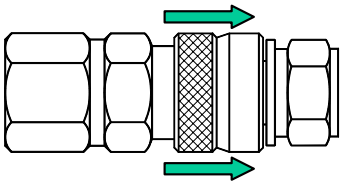
Pull the shroud back to retract



Coupling and Nipple with the shroud retracted

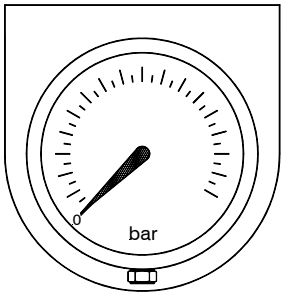


Coupling and nipple pushed together with the shroud still retracted



Shroud released - Coupling and Nipple are now locked together and safe to use.

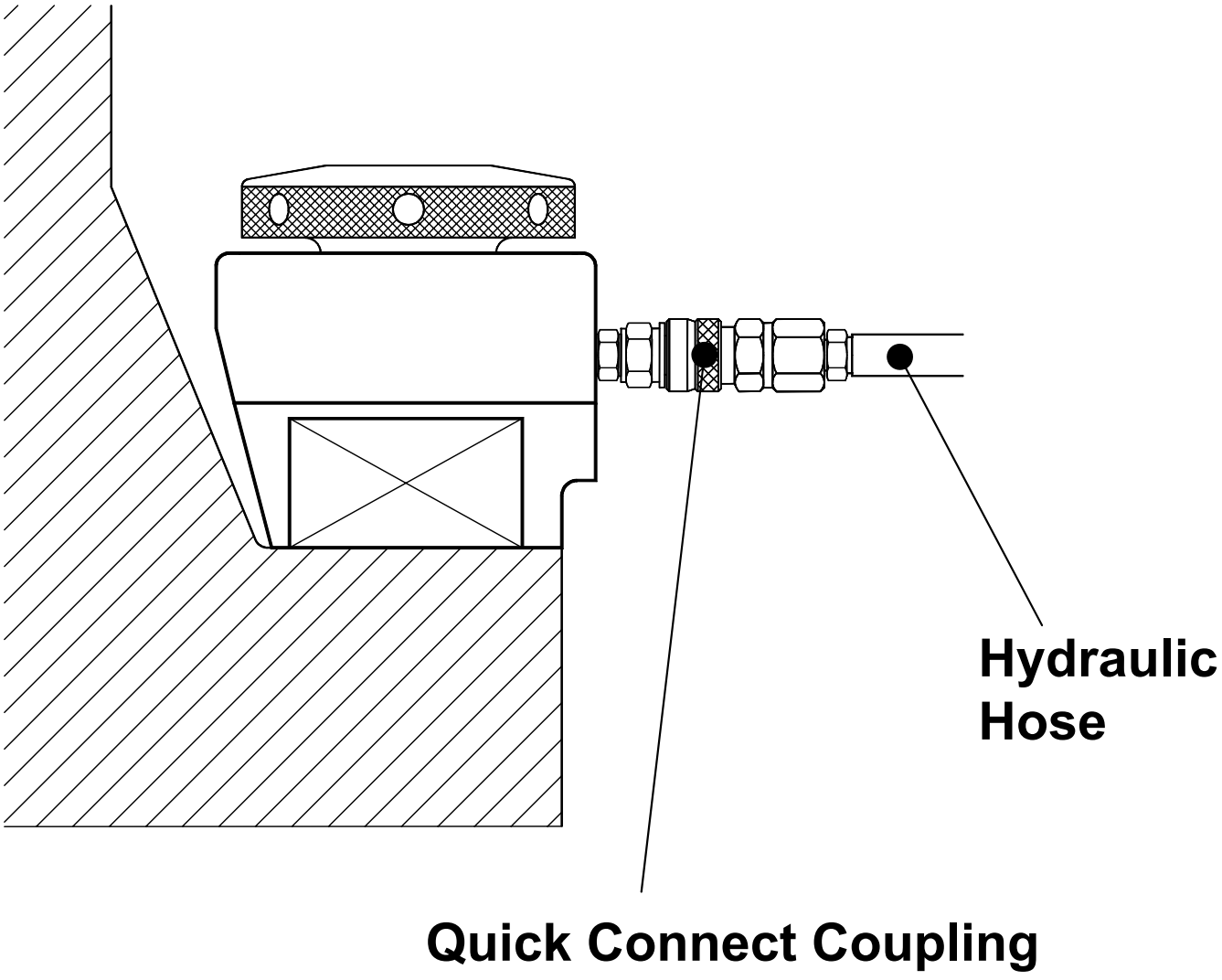
STEP 6 LOOSENING A BOLT



Connect the hydraulic hose.

Make sure the quick connect coupling is fully engaged.

DO NOT tighten the PULLER with the tommy bar.



THINK SAFETY

MOST IMPORTANT - HEALTH & SAFETY

The bolt tensioning tool is now ready to be pressurised. Before proceeding read the Health & Safety Instructions given in this manual then proceed as follows:-

Clear all personnel from the area where the bolt tensioning operation is to be performed. Position the pump a safe distance away from the bolt tensioning tools. Set up barriers and warning signs, or make other adequate arrangements to prevent unauthorised personnel from accidentally straying into the bolt tensioning area.

Make certain that nobody is allowed to stand near to a bolt tensioning tool during the pressurisation process. At no time should anyone allow any part of their body to be positioned over the PULLER of a bolt tensioning tool, whilst the pressure is rising or when it is pressurised. Do not allow anyone to stand anywhere near a direct line with the long axis of a bolt during the tensioning operation. In the case of studbolts with nuts at each end it is important that nobody stands in line with the long axis of the bolt at either end during the tensioning operation.

Do not approach a bolt tensioning tool whilst it is being pressurised. Remember that bolt or tool failure is most likely to happen at this critical time. When the operating pressure has been reached, approach a pressurised bolt tensioning tool only for as long as it takes to turn the permanent nut always keeping away from the axis of the bolt and the PULLER.

Wear eye protection, gloves overalls and a hard hat.

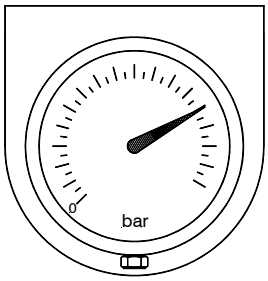
Never leave a pressurised bolt tensioning tool unattended.

Release the oil pressure immediately if any unauthorised person moves into the bolt tensioning area and especially if anyone stands in front of the PULLER of a bolt tensioning tool under pressure or stands in line with the long axis of a bolt being tensioned.

Determine the correct working pressure for the bolts to be tightened.

Proceed with the following operations keeping the bolt tensioning tools under pressure for the minimum time necessary to complete the bolt tightening job.

STEP 7 LOOSENING A BOLT

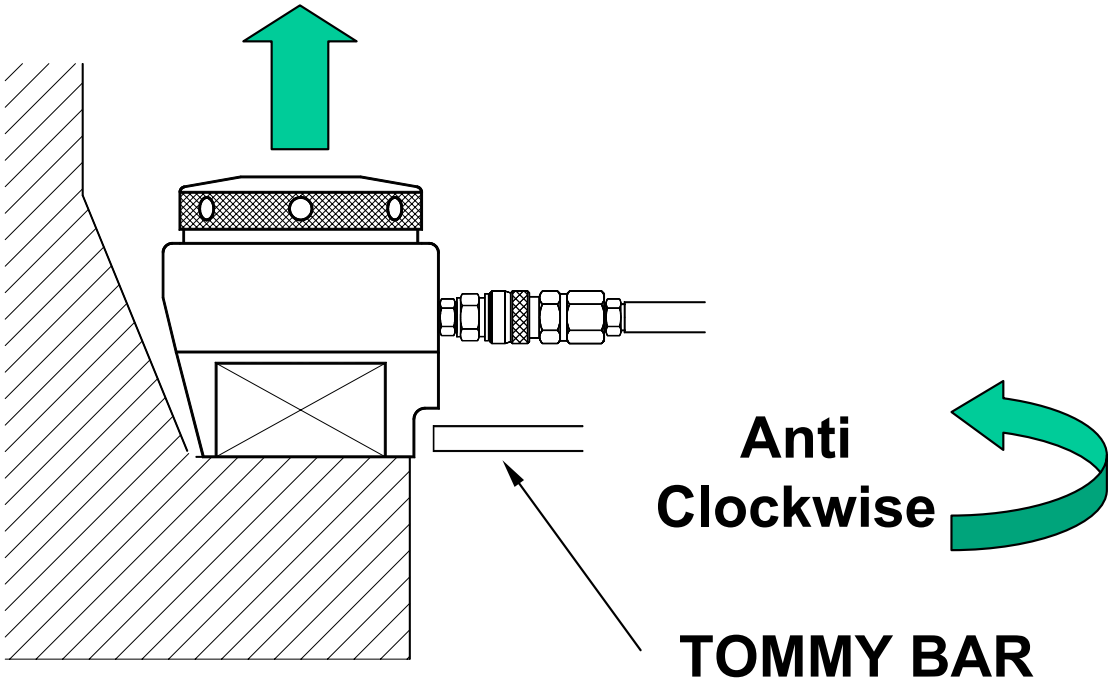


Apply the hydraulic pressure observing the Health and Safety Instructions.

Insert a tommy bar into a hole in the permanent nut and loosen the nut by turning it anti-clockwise.

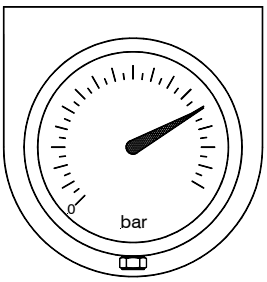
DO NOT exceed the maximum stroke. This is indicated by a red line around the piston.

DO NOT exceed the 1500 bar maximum pressure for the tool.



A highly visible red line indicates when the piston has reached its maximum stroke. Stop the pump as soon as the red indicator can be seen.

STEP 8 LOOSENING A BOLT

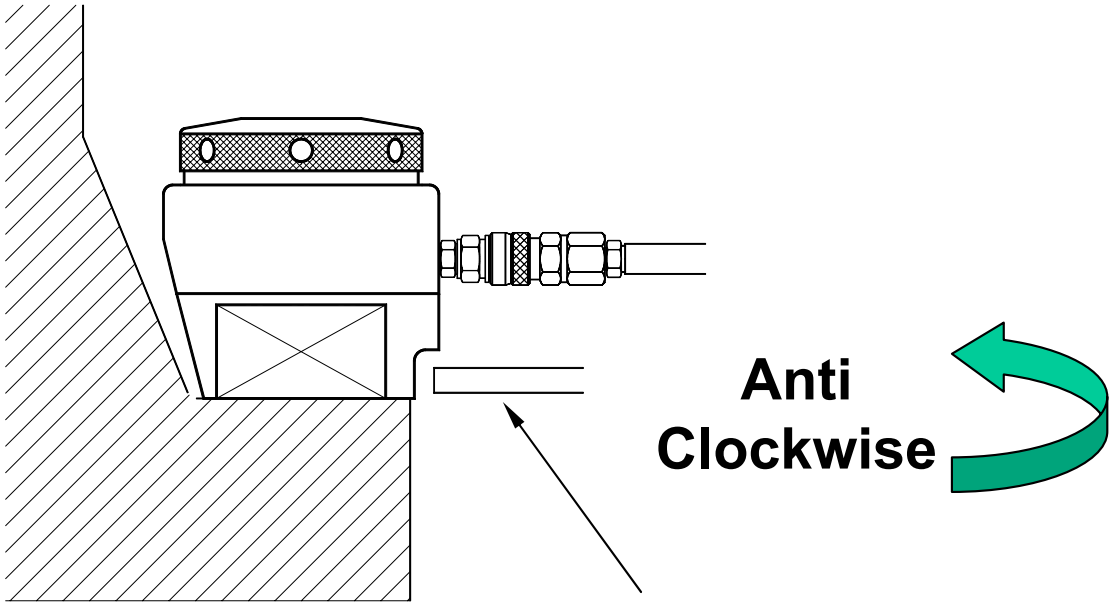


Use the tommy bar to turn the SOCKET anti-clockwise, to loosen the nut.

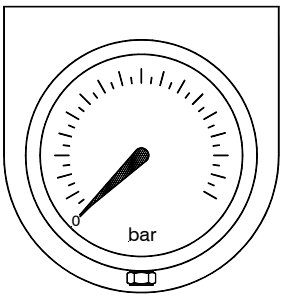
Insert the tommy bar through the window in the BRIDGE until it engages with a hole in the SOCKET.

Turn the SOCKET anti-clockwise. When the tommy bar comes into contact with the BRIDGE, remove it and engage the next hole in the SOCKET.

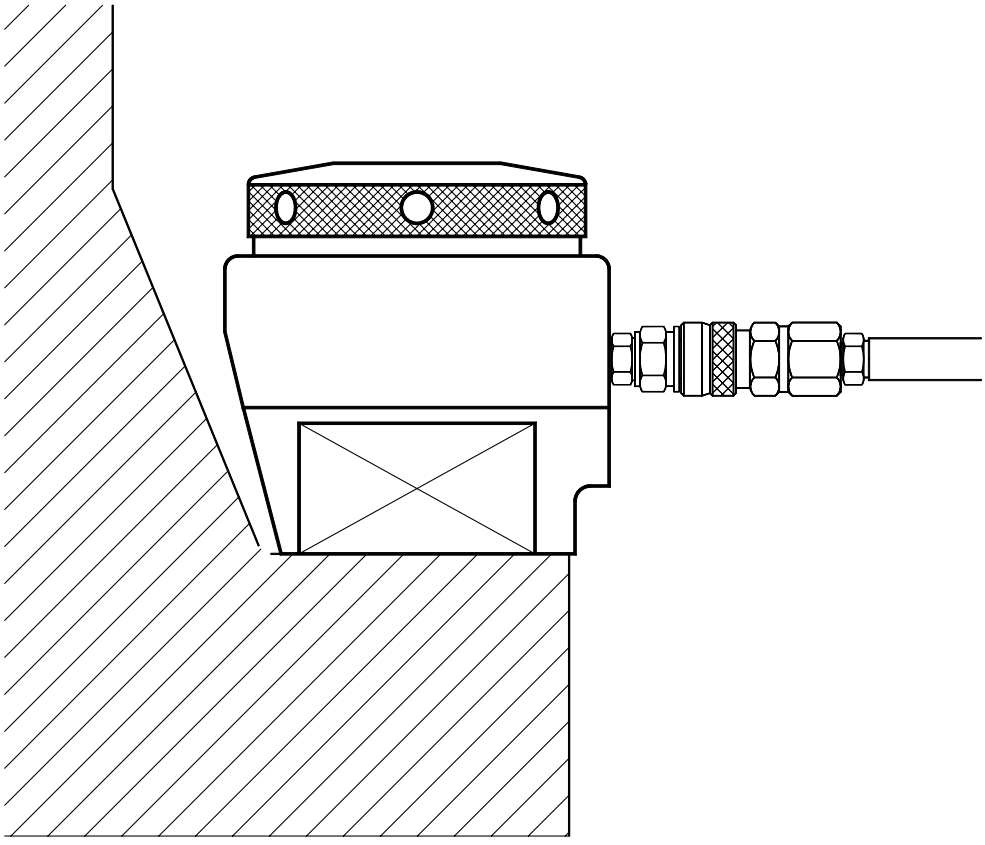
Continue turning the SOCKET until the nut has been undone one full turn. Do not let the nut come into contact with the PULLER.



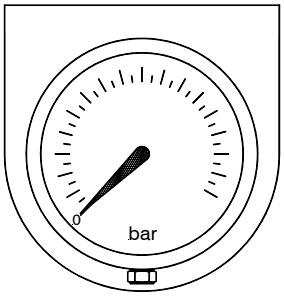
STEP 9 LOOSENING A BOLT



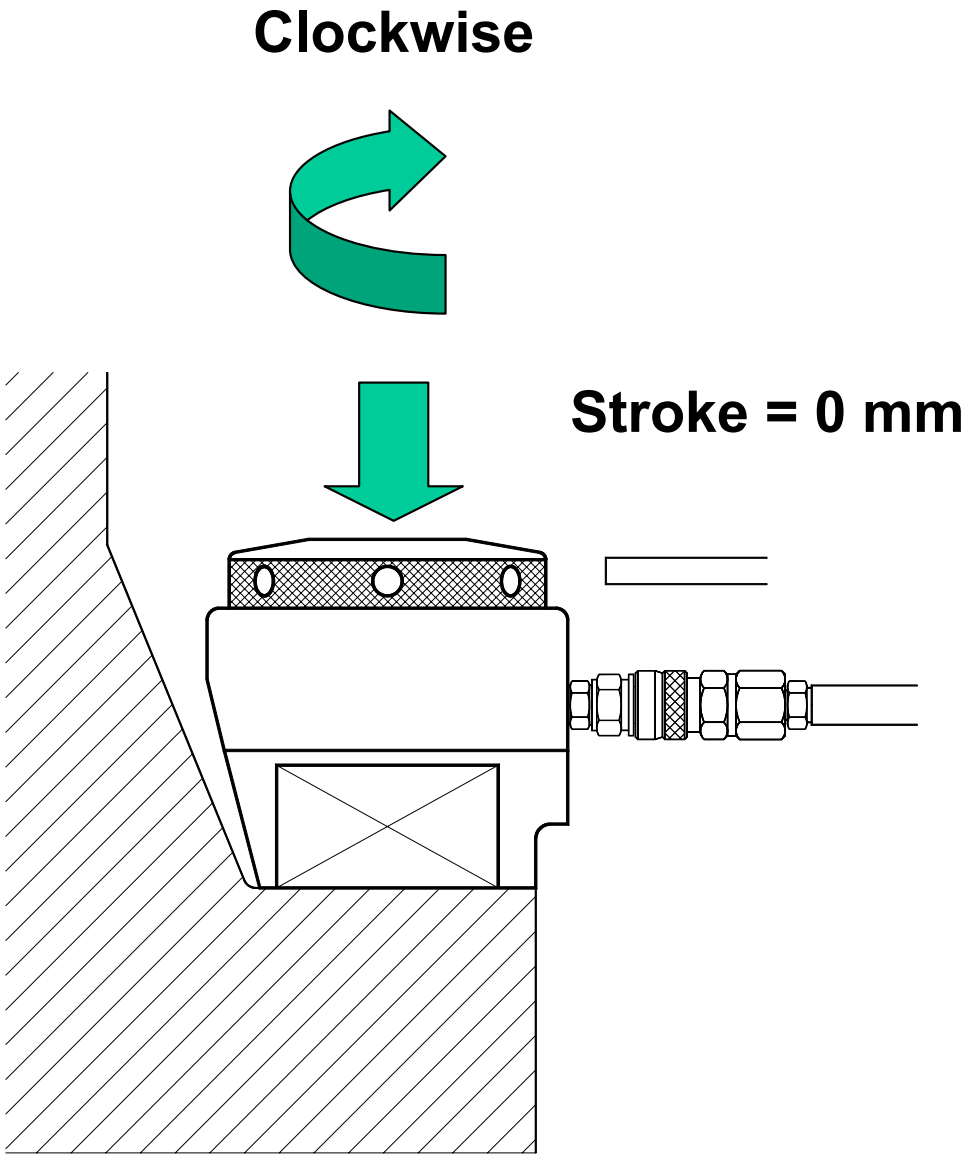
Release the pressure slowly. When the pressure has fallen to zero, fully open the oil pressure release valve on the pump.



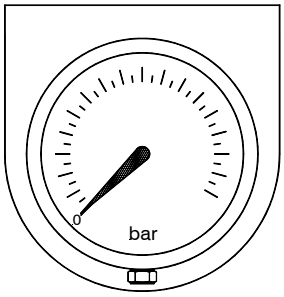
STEP 10 LOOSENING A BOLT



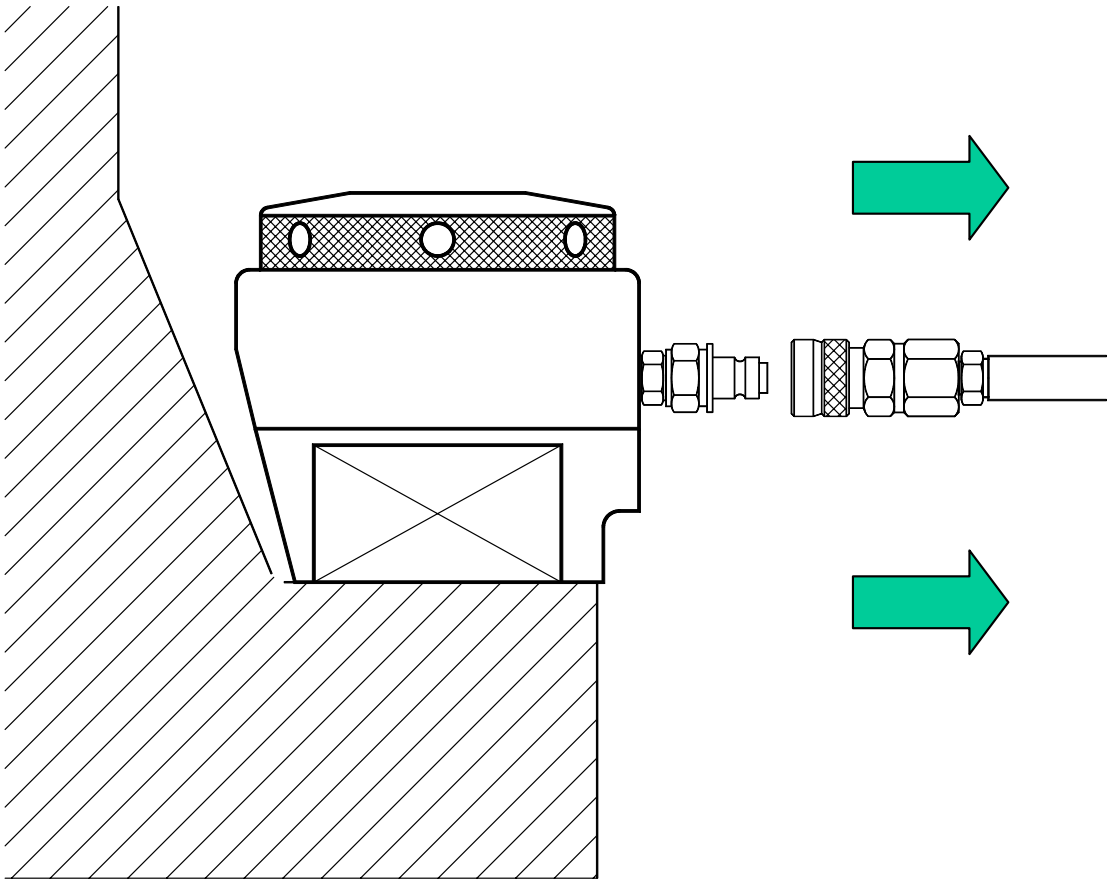
Use the tommy bar to tighten the PULLER until the Piston is fully returned into the CYLINDER. See Section 3 Page 42 for more information on returning the pistons.



STEP 11 LOOSENING A BOLT



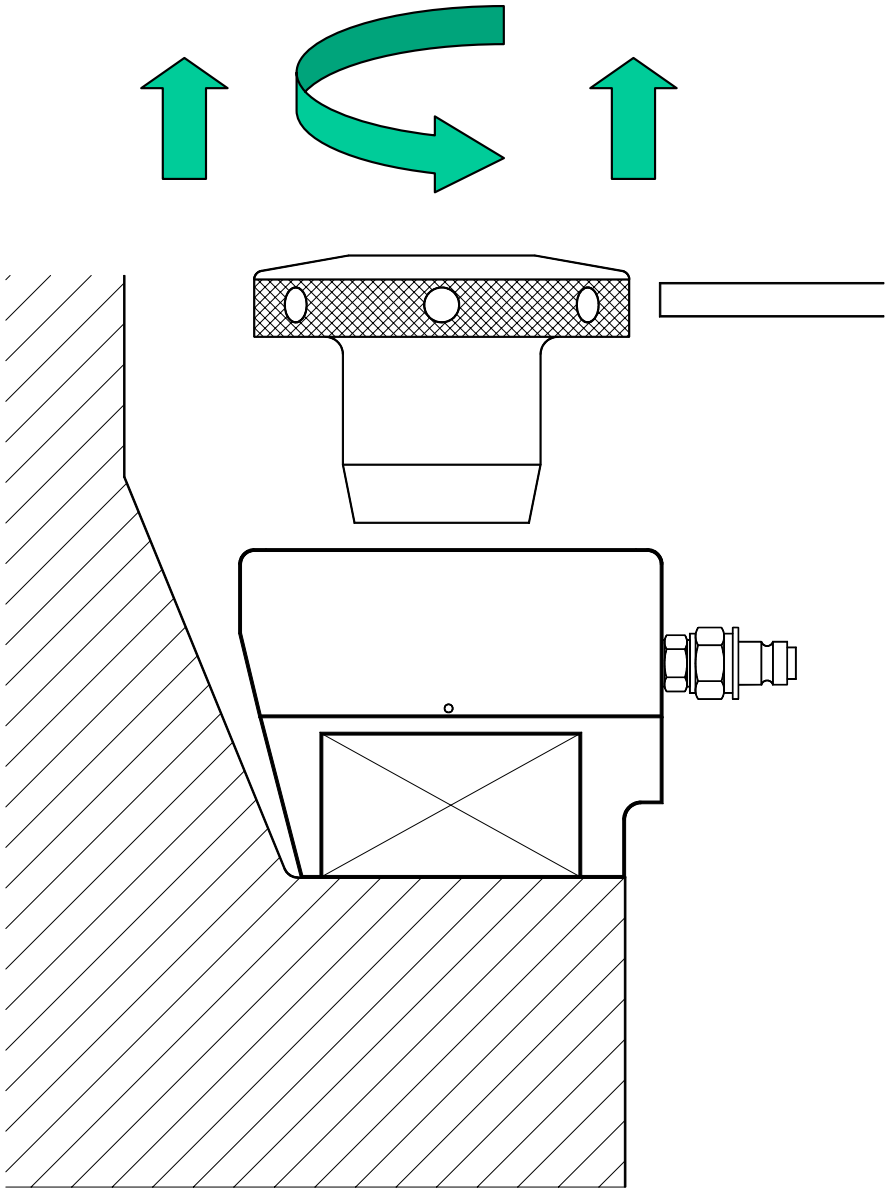
Remove the Hydraulic Hose



STEP 12 LOOSENING A BOLT

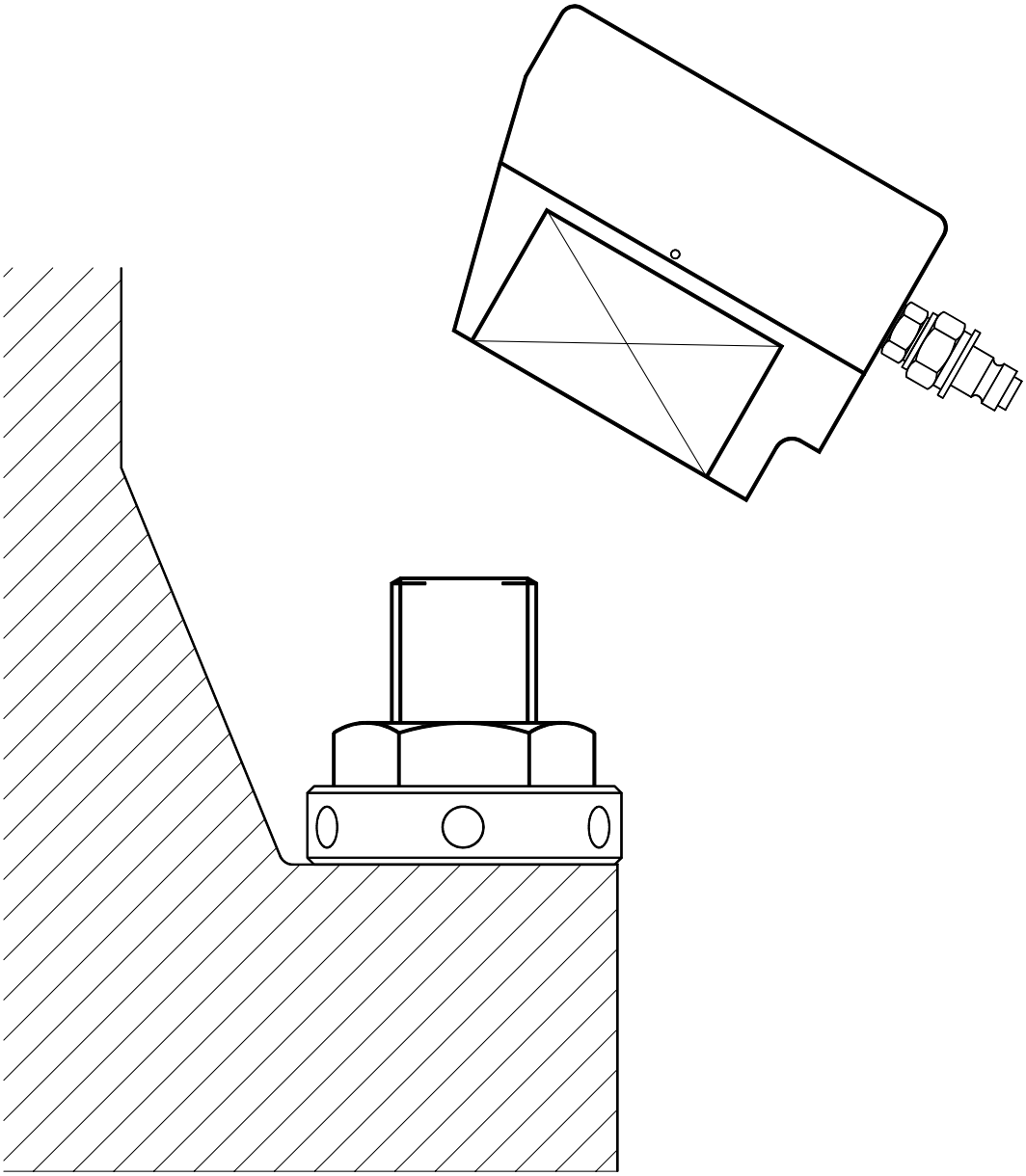
Use the Tommy Bar to release and remove the PULLER.

Anti-Clockwise



STEP 13 LOOSENING A BOLT

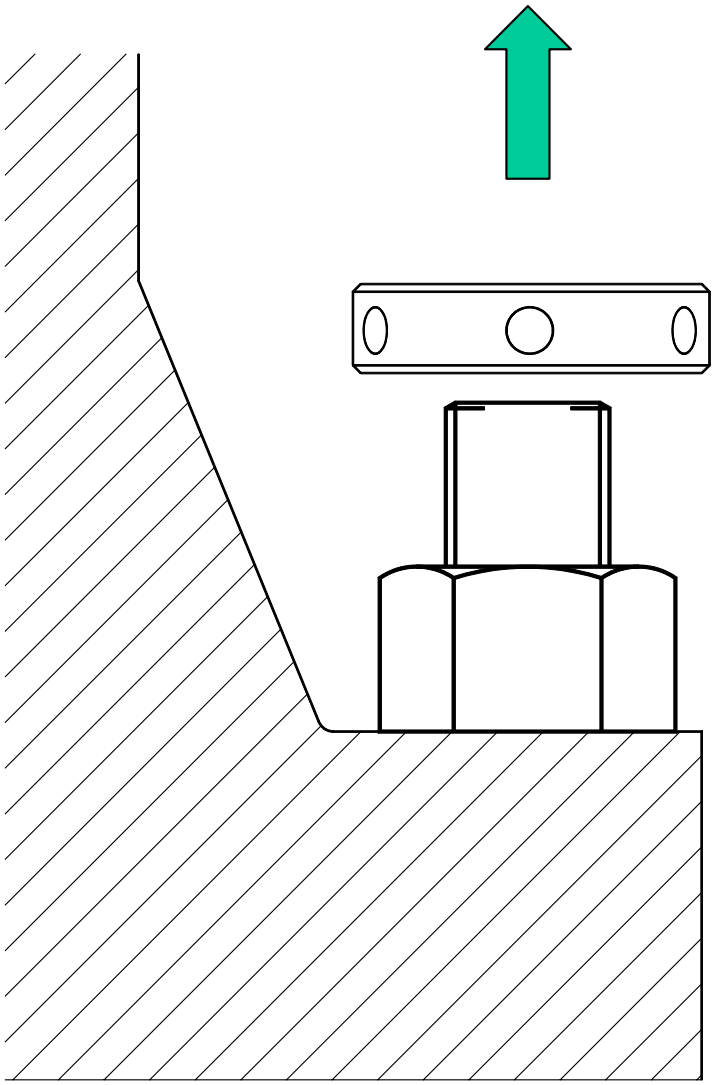
Remove the CYLINDER and BRIDGE



STEP 14 LOOSENING A BOLT

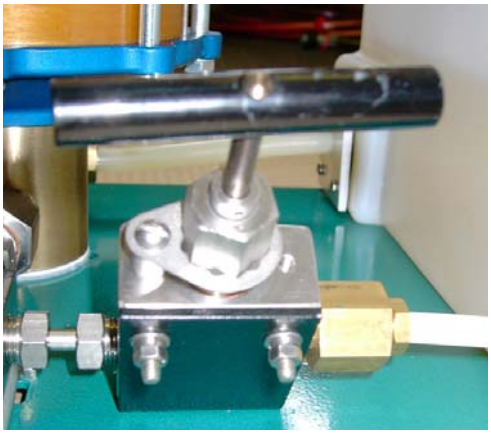
Remove the SOCKET.

The nut is now loose.



Returning the Pistons

The small bore of the oil pressure release valve on the pump is the most significant restriction to the flow of oil back to the oil reservoir.



The oil pressure release valve

Attempting to return the pistons manually using a tommy bar on the Puller will be difficult when pushing the oil through the pump pressure release valve.

To greatly reduce the force, time and effort necessary to return the pistons TITAN has provided a direct return to tank coupling on the top of the oil reservoir immediately next to the oil filler cap

A quick connector is provided on the top of the oil reservoir to bypass the pressure release valve.

Returning the Pistons

Remove the 5m link hose from the pump outlet and connect it directly to the connector on the top of the oil reservoir. Oil will now be returned to the reservoir, without passing through the oil pressure release valve.

The top of the Puller can be tapped with a rubber or plastic mallet at the same time as effort is applied to a tommy bar to turn the puller. This will assist the return of the piston.

SECTION 4

OPERATING INSTRUCTIONS

SIMULTANEOUS BOLT TENSIONING

In flanged applications, TITAN strongly recommends simultaneous tensioning of 100% of the bolts if space allows. If insufficient space is available it is usually possible to simultaneously tighten 50% of the bolts. The time required to complete the bolt tensioning operation will be a minimum when 100% tensioning is used. In a gasket and flange application 50% tensioning will take more than twice the time when compared with 100% tensioning. This is because the gasket is not always fully compressed by tightening only half the bolts. Tightening the second half will cause the gasket to compress further reducing the tension in the first bolts tightened and necessitating a return to the first bolts. If the gasket compresses further a return to the second set of bolts may also be necessary. Even so, this method is far quicker and superior to conventional tightening methods which suffer even more from the gasket compressing as each bolt is tightened.

The method for simultaneous tensioning is similar to tightening one bolt, but requires an additional operation. This involves using flexible hoses to gang the tools and the hydraulic pump together so that oil under pressure will be supplied to all of the tools simultaneously.

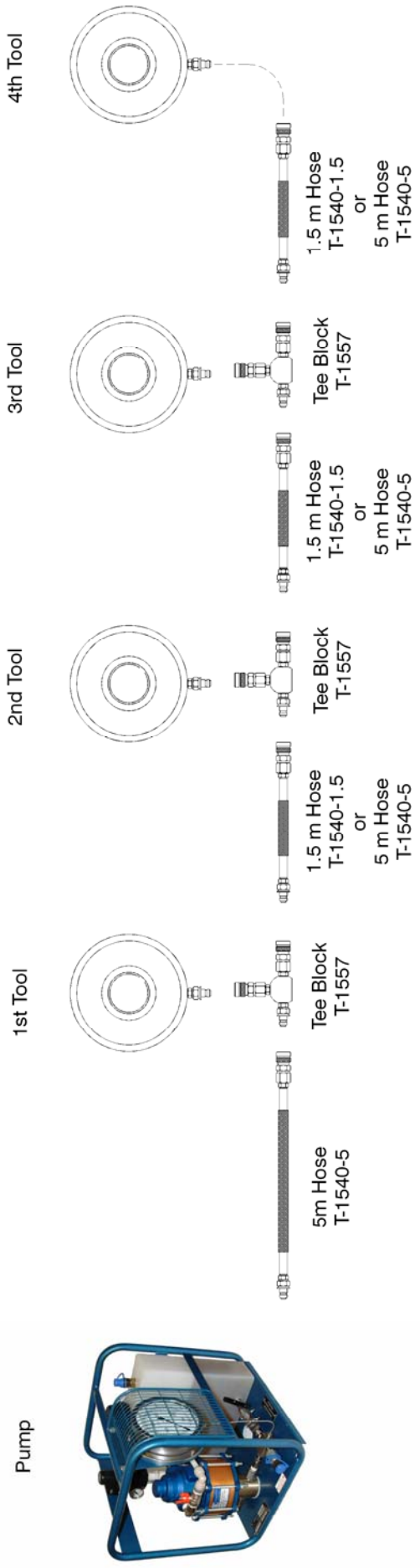
Connecting for Simultaneous Operation

The diagram on the next page, shows how four tools can be connected together for simultaneous operation using an air driven pump, flexible hoses and tee blocks.

The 5m long and 1.5 m long hoses may be interchanged at will to construct the hydraulic ring main that best suits the users application.

There is no right or wrong way to connect the tools together. Titan provides a wide range of block and hose assemblies to enable any number of tools to be connected together for simultaneous operation no matter how far apart they might be.

The user is free to construct the ring main that best suits his application, it is only necessary to ensure that oil can flow to all of the tools simultaneously.


4th Tool
3rd Tool
2nd Tool
1st Tool
Pump
1.5 m Hose T-1540-1.5 or 5 m Hose T-1540-5
Tee Block T-1557
1.5 m Hose T-1540-1.5 or 5 m Hose T-1540-5
Tee Block T-1557
1.5 m Hose T-1540-1.5 or 5 m Hose T-1540-5
Tee Block T-1557
5m Hose T-1540-5

SECTION 5

MAINTENANCE AND STORAGE INSTRUCTIONS

MAINTENACE AND STORAGE INSTRUCTIONS

Introduction

A hydraulic bolt tensioning tool will provide many years of trouble free service if used, maintained and stored correctly.

Storage

Each tool is chemically blacked before leaving the factory. This provides a degree of corrosion protection but additional protection should be applied when the tools are to be stored for any period of time. It is recommended that, before storage, the tools should be dismantled into their four major components:-

1. Puller
2. Cylinder
3. Bridge
4. Socket

Each of these items should be checked for damage and if OK, lightly oiled and the tool reassembled.

The reassembled tool must have the piston returned to the zero stroke position and the hydraulic connection must have it's plastic protective cap fitted. The hydraulic bolt tensioner should be stored upright in a clean, dry environment.

Maintenance.

Very little maintenance is required for a bolt tensioning tool. The only items which may require changing will be the seals and the quick connect fittings.

Changing seals.

Each bolt tensioning tool has an inner and an outer seal set. Each seal set consists of a rubber "O" ring and an elastomeric seal. If the seals are damaged or badly worn, the complete set ("O" ring and seal) must be changed. It is recommended that both inner and outer sets are changed at the same time.

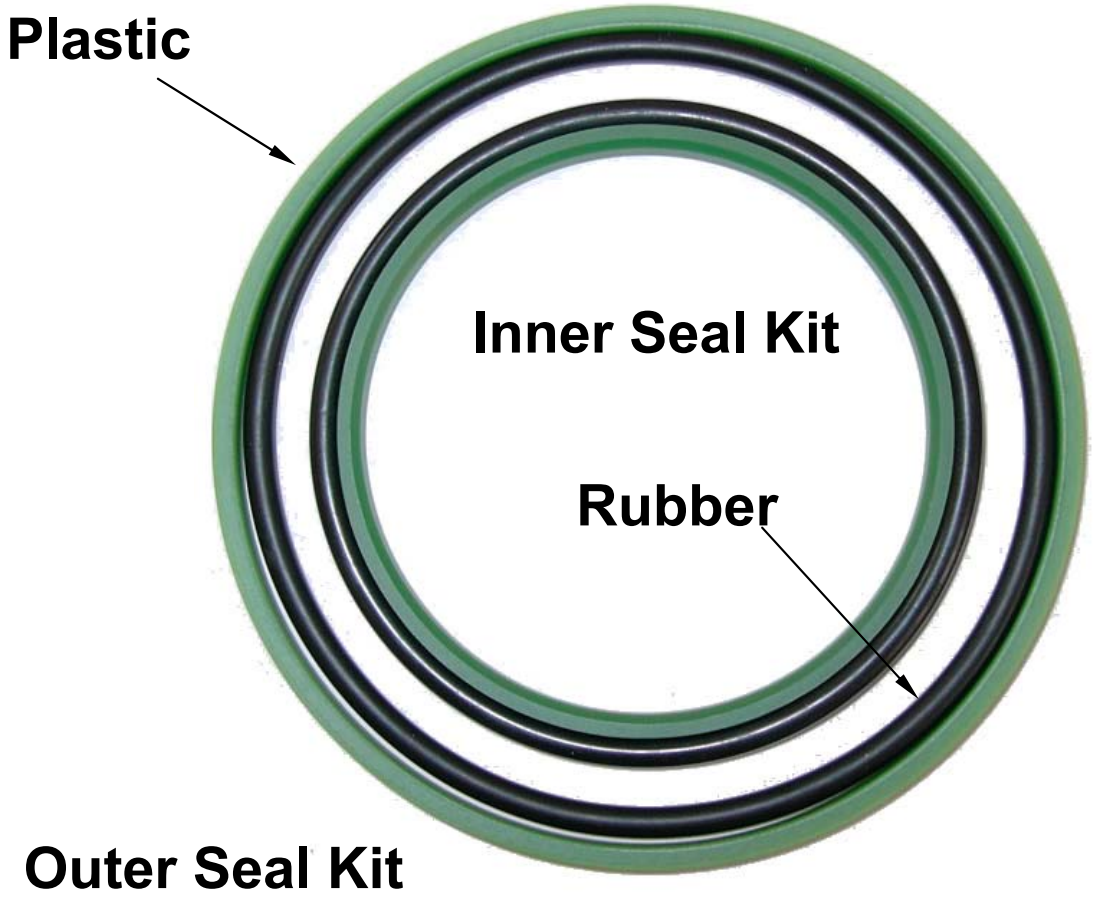
To change the seals, the piston must be withdrawn from the cylinder. If the seals are not badly damaged this may be achieved by carefully blowing compressed air into the cylinder through the quick connect nipple. All applicable Health and Safety precautions relating to the use of compressed air must be observed. In addition suitable safe provision must be made to catch the piston and any escaping oil when it leaves the cylinder.

If the seal damage is too great to allow air to be used, the piston may be removed by making a simple piston extraction tool from a bar of steel. The bar must be drilled with two holes to align with the threaded holes found in the top of the piston. Two screws can be used to secure the bar to the piston. The piston can then be pulled from the body using the bar.

Changing the Seals

The seals used do not run dry. They are self lubricating and will always exhibit a small amount of oil around the inner and outer edges of the piston. The presence of a small volume of oil around the piston is NOT a signal the seals need to be changed. It is normal and to be expected. The oil lubricates the cylinder wall, reduces the force required to return the piston and helps to prevent corrosion. After extensive use as much as 5 ml of oil may be present around the piston. Simply wipe away any oil when the tools have been used. The seals will need to be changed only if the tool will not pressurise or a very large volume of oil escapes whilst the oil pressure is being increased, or if the tool will not hold pressure.

Each bolt tensioning tool has an inner and an outer seal kit. Each seal kit consists of a rubber “O” ring and a plastic seal. If the seals are damaged or badly worn, the complete set (“O” ring and seal) must be changed. It is recommended that both inner and outer sets are changed at the same time. To change the seals, the piston must be withdrawn from the cylinder.



Changing the inner piston seal

These instructions should be read in conjunction with the drawings and photographs shown on the following pages.

The old seal set must be removed by cutting through the seal with a knife. The “O” ring can be removed by cutting or by levering it out. Both items should be discarded.

Ensure the seal groove is clean. Lubricate the “O” ring with grease.

Fit the “O” ring into the centre of the body, folding the ring slightly to fit it in. Manoeuvre the “O” ring into the seal groove.

Ensure the “O” ring is firmly in the groove and seated in the bottom of the groove. Now pack the “O” ring with grease.

Place the plastic seal in the groove working from the bottom and smallest diameter end of the Piston, ensuring the chamfered face of the seal faces towards the bottom of the Piston.

Enter the seal into the seal groove and ensure that it is as far into the groove as possible.

Carefully fit the rest of the seal into the groove using only hand force. Work around the Piston Take care not to twist the seal.

When the seal is in place, the last section to be fitted may protrude beyond the Piston a greater amount than the rest of the seal. Centralise the seal using only hand force.

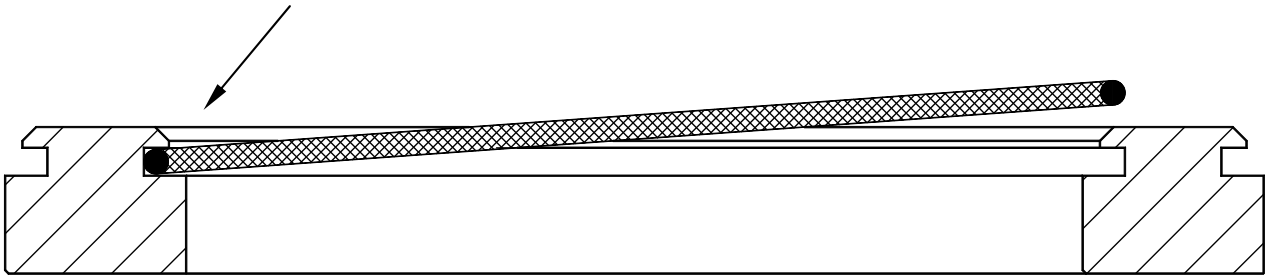
Wipe away any excess grease.

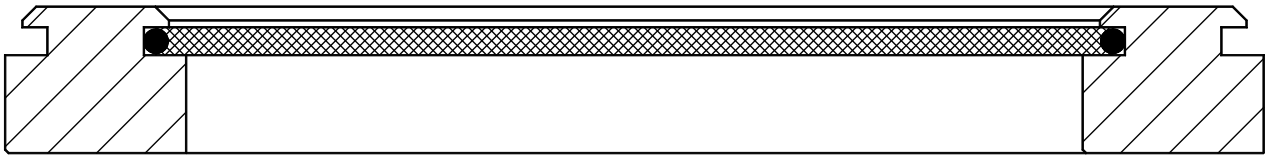
The inner seal is now correctly fitted to the Piston

Changing the inner piston seal

Lubricate the O Ring with grease

Fit the “O” ring into
one side of the groove

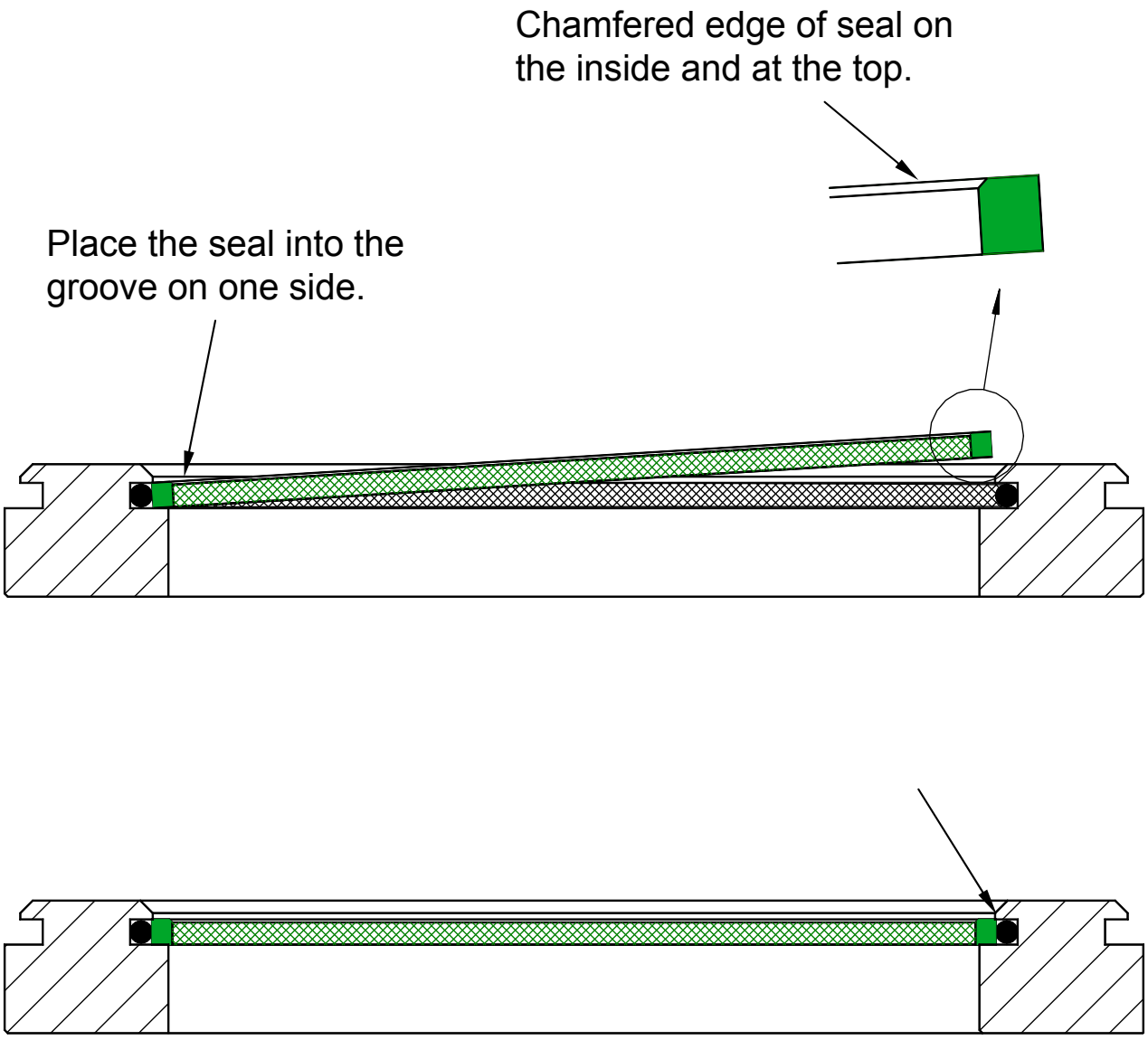




Snap the “O” ring into seal groove

Now pack the “O” ring with grease

Changing the inner piston seal



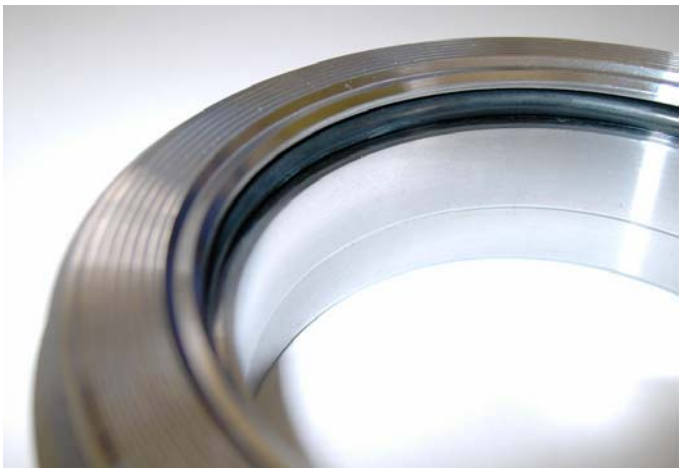
Using finger pressure only, press the seal until it snaps into the groove.

Changing the inner piston seal

Lubricate the O Ring with grease

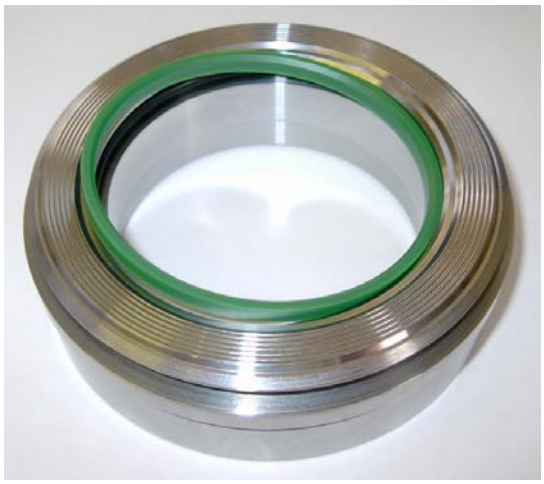
Place the Piston on a clean surface and insert the Rubber O Ring into the seal groove.

Fit the O Ring into the seal groove



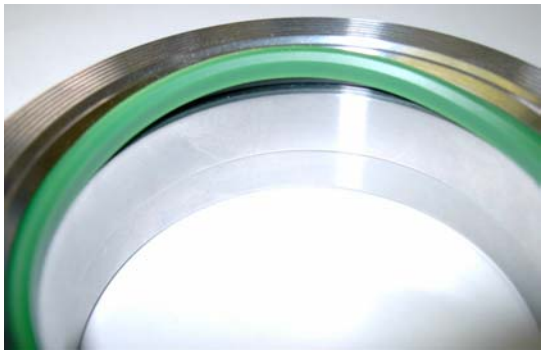
Pack the “O” ring with grease.

Changing the inner piston seal

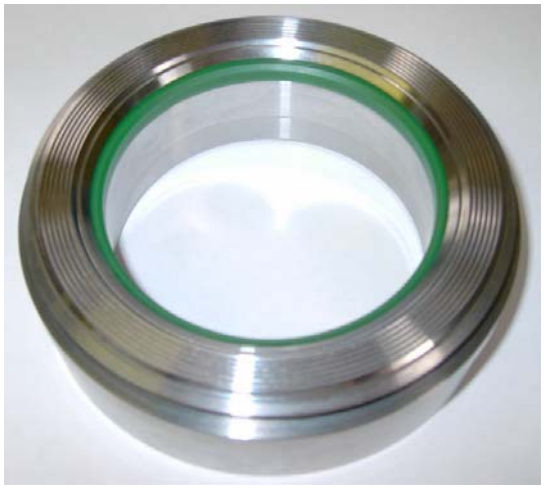


Insert the green plastic seal into the seal groove. Make sure the chamfer is at the top.

Work the seal into the groove using hand force only.



The seal will snap into the seal groove.



Wipe away any excess grease.

Changing the outer piston seal

These instructions should be read in conjunction with the drawings and photographs on the following pages.

The old seal set must be removed by cutting through the seal with a knife. The “O” ring can be removed by cutting or by levering it out. Both items should be discarded.

Ensure the seal groove is clean.

Lightly lubricate the “O” ring with grease and fit it over the narrow end of the piston. Carefully stretch the ring over the retaining lip and snap it into the seal groove.

Now pack the O ring with grease

Fit the plastic seal over the bottom end of the piston making sure the chamfered side of the seal is facing towards the smallest diameter.

Carefully manipulate one side of the seal into the seal groove until it sits on the “O” ring. Push the seal as far into the seal groove as possible.

Carefully ease the seal over the seal retaining lip, starting from the point where the seal is already in the groove. Work both ways around the piston simultaneously.

The process will slightly stretch the seal. Use only your hands to stretch the seal. Do not insert anything between the seal and the piston to force the seal into place as this may damage or cause excessive stretching of the seal. Take care not to twist the seal.

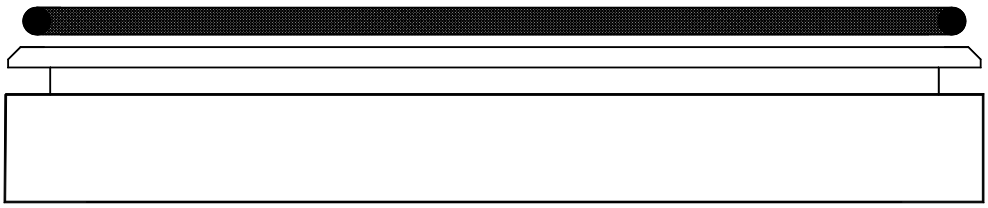
When the seal is in place the last part to be fitted may protrude beyond the piston a greater distance than the rest of the seal. Centralise the seal using your fingers to manipulate the it.

Wipe away any excess grease.

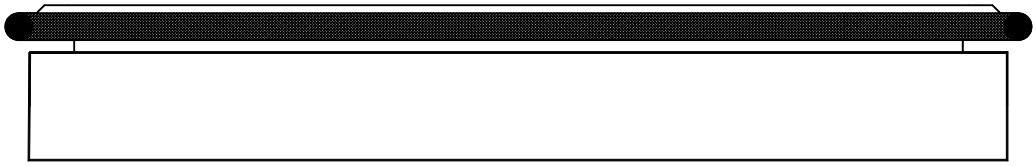
The outer seal is now correctly fitted to the Piston.

Changing the outer piston seal

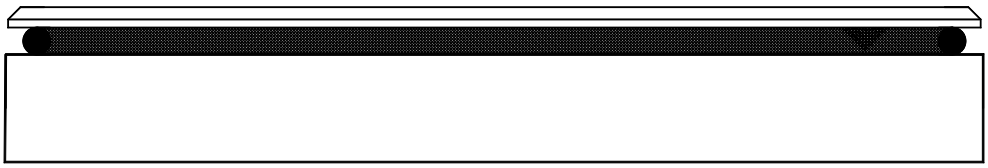
Lubricate the O Ring with grease



Place the “O” ring onto the piston



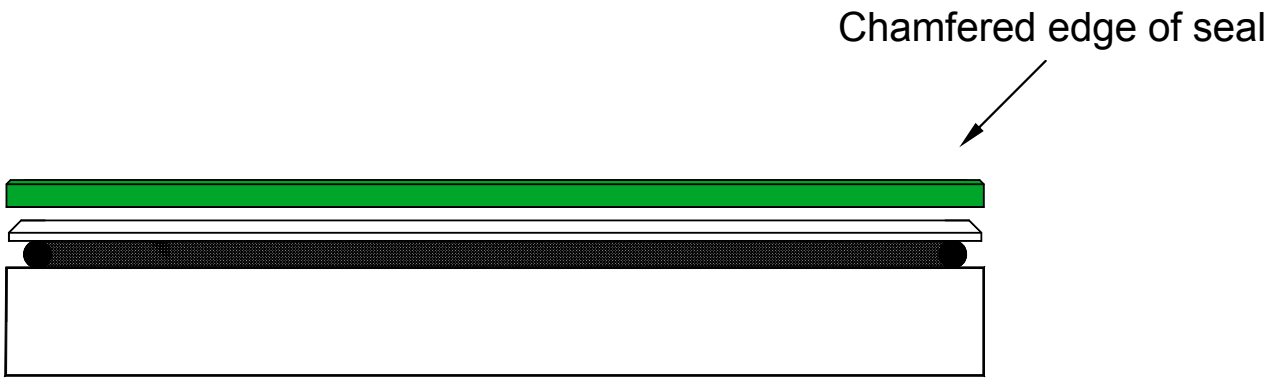
Stretch “O” ring over seal retaining lip



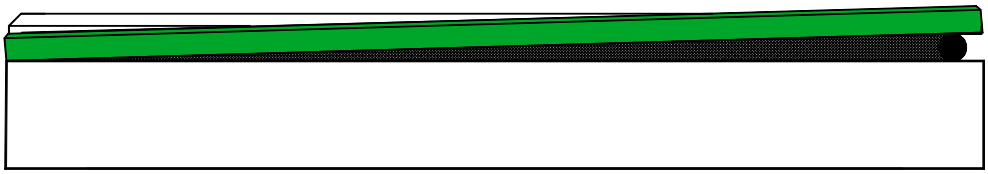
Snap “O” ring into seal groove

Now pack the O ring with grease

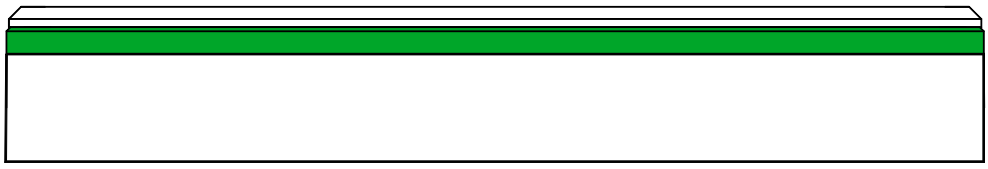
Changing the outer piston seal



Place the seal over the end of the piston

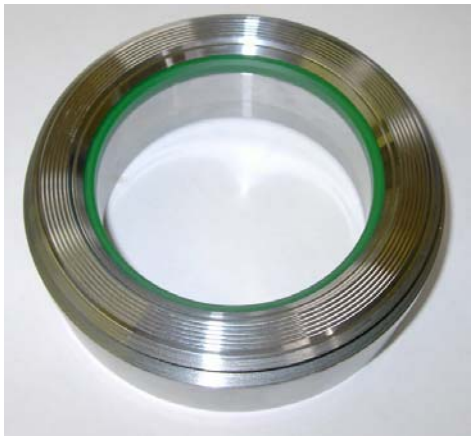


Stretch the seal over the seal retaining lip

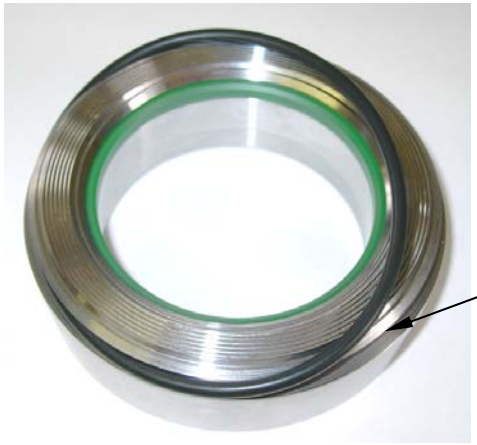


Snap the seal into the seal groove

Changing the outer piston seal



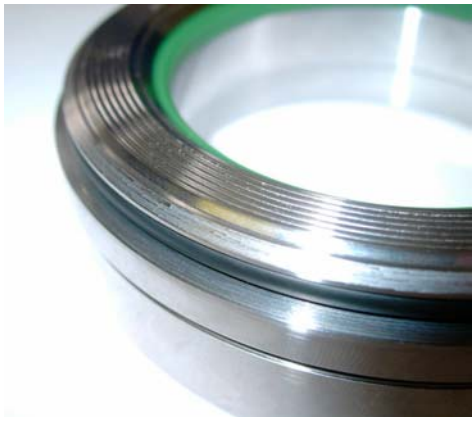
Place the Piston on a clean surface



Lubricate the O Ring with grease.

Insert the Rubber O Ring into the seal groove.

Stretch the O Ring until it snaps into the seal groove

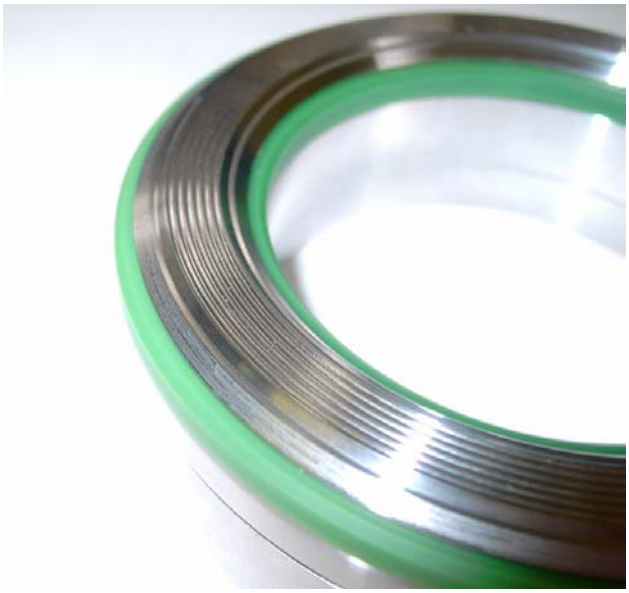


Pack the O Ring with grease.

Changing the outer piston seal

Insert the green plastic seal into the seal groove. Make sure the chamfer is at the top.

Stretch the seal over the outer lip of the piston by working around both sides of the piston simultaneously.

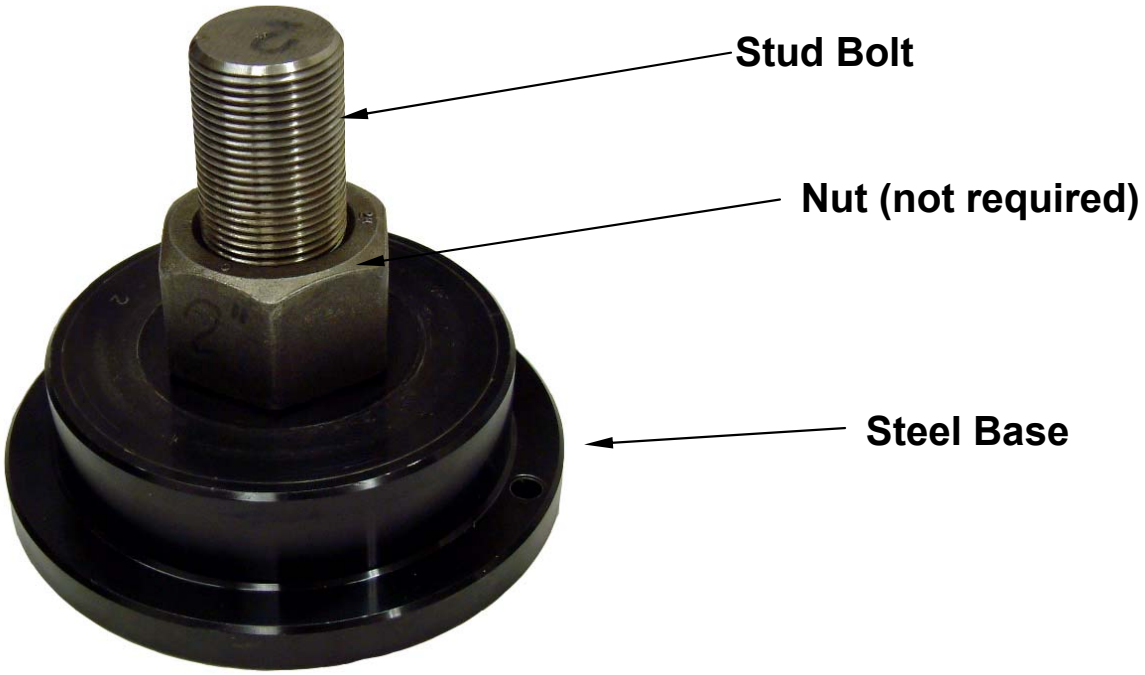


Work the seal into the groove using hand force only.

Wipe away any excess grease.

Fitting the Piston

BOLTIGHT recommends that the easiest and safest method of fitting a piston into any of our standard tools is by using a test block such as the one shown below. This can be easily manufactured with a steel base threaded through the centre to accept the correct stud bolt for the tool in question. Assuming that the test block has been manufactured from the appropriate grade of steel, it can also be used to pressure test the tools once the pistons are fitted.



Alternatively the piston could be fitted using an application bolt on a flange that is to be tensioned. The principal remains the same.

To fit the piston proceed as follows :-

Firstly, make sure the cylinder and piston are clean and free from foreign objects and dirt. Lubricate the cylinder walls and the seals of the piston with hydraulic oil.

Fitting the Piston Cont.

Assemble the tool on the bolt as normal; bridge followed by cylinder.

Ensure that you fit an open quick connect coupling to the hydraulic connection to enable air to be expelled from the cylinder as the piston is pushed in.

Place the piston over the cylinder. Ensure that the piston is correctly aligned with the cylinder.

Fitting the Piston Cont.

Now wind the puller down onto the bolt until it is in contact with the piston. Once again, check that the piston is aligned correctly with the cylinder.

Using a tommy bar, gently wind the puller down the bolt, easing the piston into the cylinder. This should not require much force. The seals can be easily damaged if the piston is not aligned correctly with the cylinder.

Once the puller is fully down, the piston is fitted. Remove the open quick connect coupling. The seals can now be energised and the tool tested as it stands (see next page).

The cylinder with a correctly fitted piston.

Energising the Seals

After fitting new seals and before the Bolt Tensioning Tool can be used, the new seals must be energised.

Observing the safety instructions give in Section 2 and Section 3 of this manual proceed as follows :-

Make sure the PISTON is fully returned into the CYLINDER Body

Using a test bolt, or an actual bolt to be tensioned, lower the bolt tensioning tool onto the bolt.

Screw the Puller onto the bolt. Centralise the tool if necessary, to allow the Puller to fit into the centre of the tool. Turn the Puller by hand until it comes into contact with the top of the Puller.

Wind back the Puller ONE FULL TURN.

Connect the tool to the pump.

Run the pump quickly and pump oil into the tool. Air and oil may escape from the seals during this operation and the pressure gauge may indicate rising and falling pressure at each stroke of the pump.

If the seals have been properly fitted the seals will quickly energise. Any leakage from the seals will stop and pressure will start to be generated in the tool.

Stop the pump when the pressure reaches 1000 bar.

The pressure should be steady and not fall, to show the seals are working.

When satisfied the seals are functioning, release the oil pressure.

The seals are now energised and the tool is ready for use.

If the seals will not energise, the tool must be taken apart again because the seals have not been correctly fitted. The seals may not energise if the pump is unable to deliver oil quickly enough.

Fitting a Quick Connector

To fit a quick connect nipple or coupling to the hydraulic cylinder you will need a quick connector T-1501 or T-1502 and a male/male threaded adaptor T-1503, and a suitable spanner.

Fitting either the quick connect nipple or coupling, can be achieved by following the simple steps shown below.

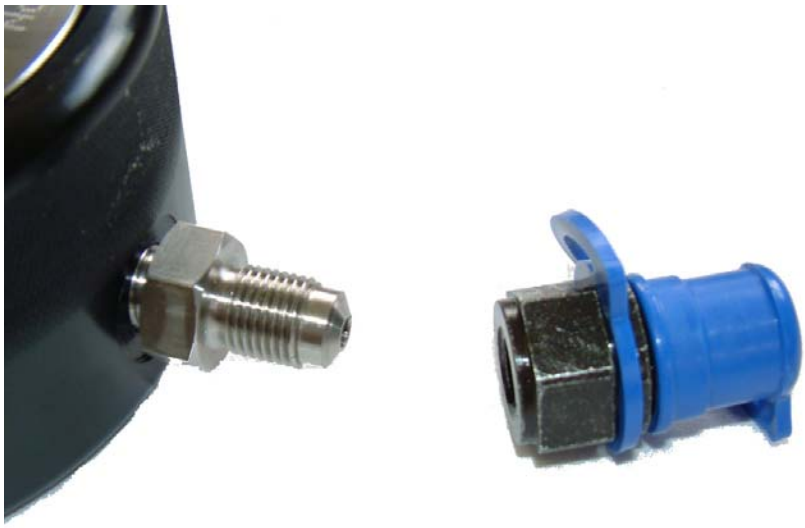
Check the internal and external threads are clean and free from damage

Screw the adaptor into the hydraulic cylinder.

The adaptor is identical at each end so it does not matter which end is inserted into the cylinder.

Tighten the adaptor firmly onto the cylinder using a spanner.

Fitting a Quick Connector



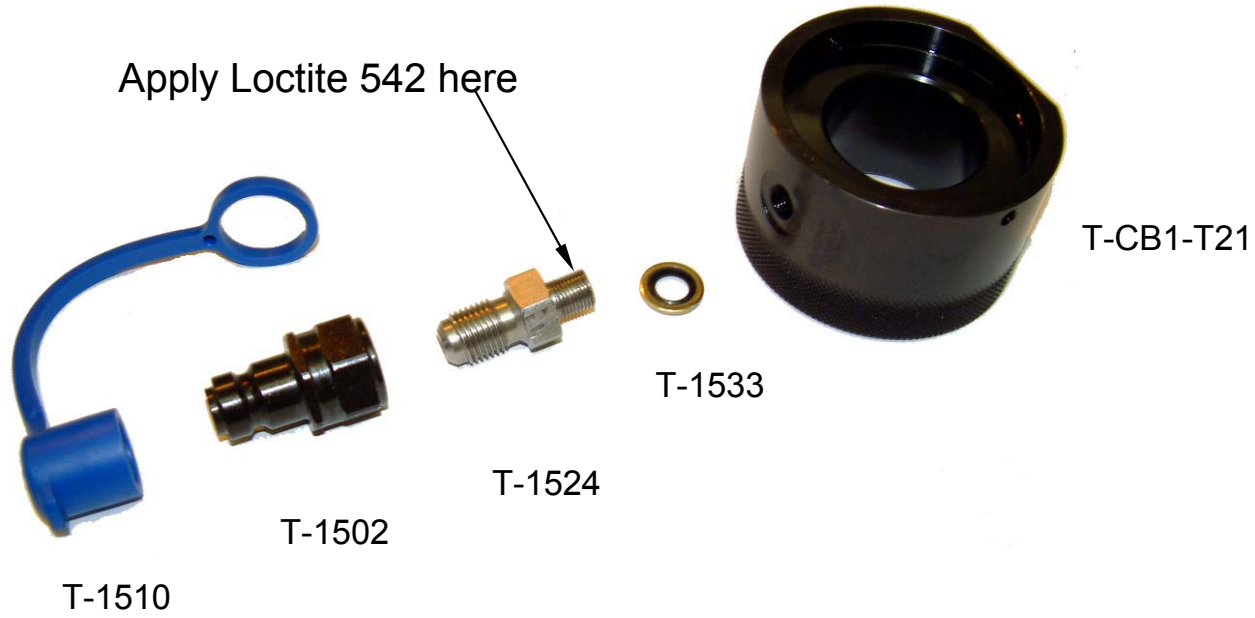
Screw the Nipple or Coupling onto the adaptor

Using a spanner, firmly tighten the quick connector onto the adaptor.

Fitting a Quick Connector Tool No 21

To fit a quick connect nipple to the hydraulic cylinder for Tool No 21 you will need a quick connector T-1502, a male/male threaded adaptor T-1524, a bonded washer seal T-1533 and a suitable spanner.

Fitting either the quick connect nipple or coupling, can be achieved by following the simple steps shown below.



Check the internal and external threads are clean and free from damage. Hold the adaptor T-1524 in a vice. Screw the quick connect nipple T-1502 onto the ¼" BSP end of the adaptor and tighten with a spanner.

Now place the 1/8" BSP bonded washer seal T-1533 onto the 1/8" BSP end of the adaptor T-1524. Apply Loctite hydraulic sealant No 542 onto the 1/8" BSP thread of the adaptor.

Screw the adaptor into the hydraulic cylinder body and tighten with a spanner. Fit the plastic dust cap T-1510.

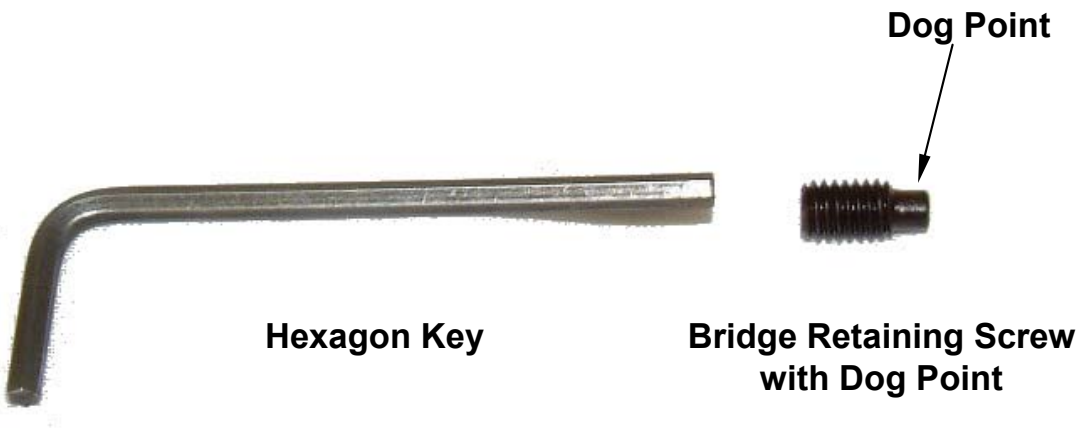
T-CA1-T21

Removing and Fitting the Bridge

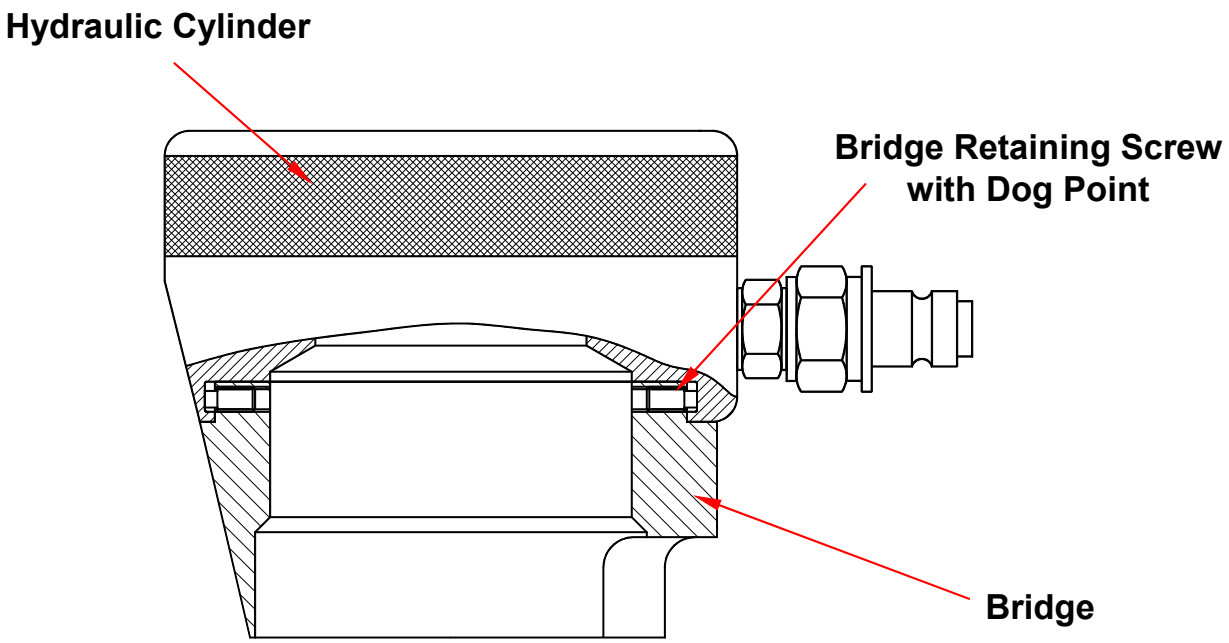
The Bridge and the Hydraulic Cylinder can be held together as one piece.

When using the tools it is sometimes advantageous to work with three separate parts, however when it is better for the Hydraulic Cylinder and the Bridge to be joined, Bridge Retaining Screws are used.

Depending on the tool, two or three Bridge Retaining Screws may be used. The screws are Socket Head Screws with Dog Points. They are located in radial drilled and tapped holes near the top of the Bridge.



The screws remain in the Bridge but the Dog Point can be advanced into the groove machined in the recess, in the base of the Hydraulic Cylinder. A hexagon key is used to advance or withdraw the Bridge Retaining Screws working from the inside of the Bridge. It is not necessary to remove the screws for the Bridge and Cylinder to be separated. The screws need only be withdrawn into the Bridge wall by 2 to 3 mm to disengage the dog point from the groove.



Removing and Fitting the Bridge

Bridge showing radial bridge retaining screw with dog point and hexagon key

When refitting the Bridge, the Retaining Screws need only be advanced enough for the dog points to locate into the groove in the Hydraulic Cylinder. If they are fully advanced and tightened, the Bridge will be locked into the Hydraulic Cylinder which is not recommended. If the screws are advanced but not tightened, the Bridge and the Cylinder will be permanently joined but the two components will rotate relative to each other. This can be useful as the Hydraulic Cylinder can be rotated until the quick connectors are in the best position for the flexible hoses to be connected whilst the window in the Bridge is in the best position for access to the nuts with a tommy bar.

Bridge retaining screw being advanced or retracted with the hexagon key